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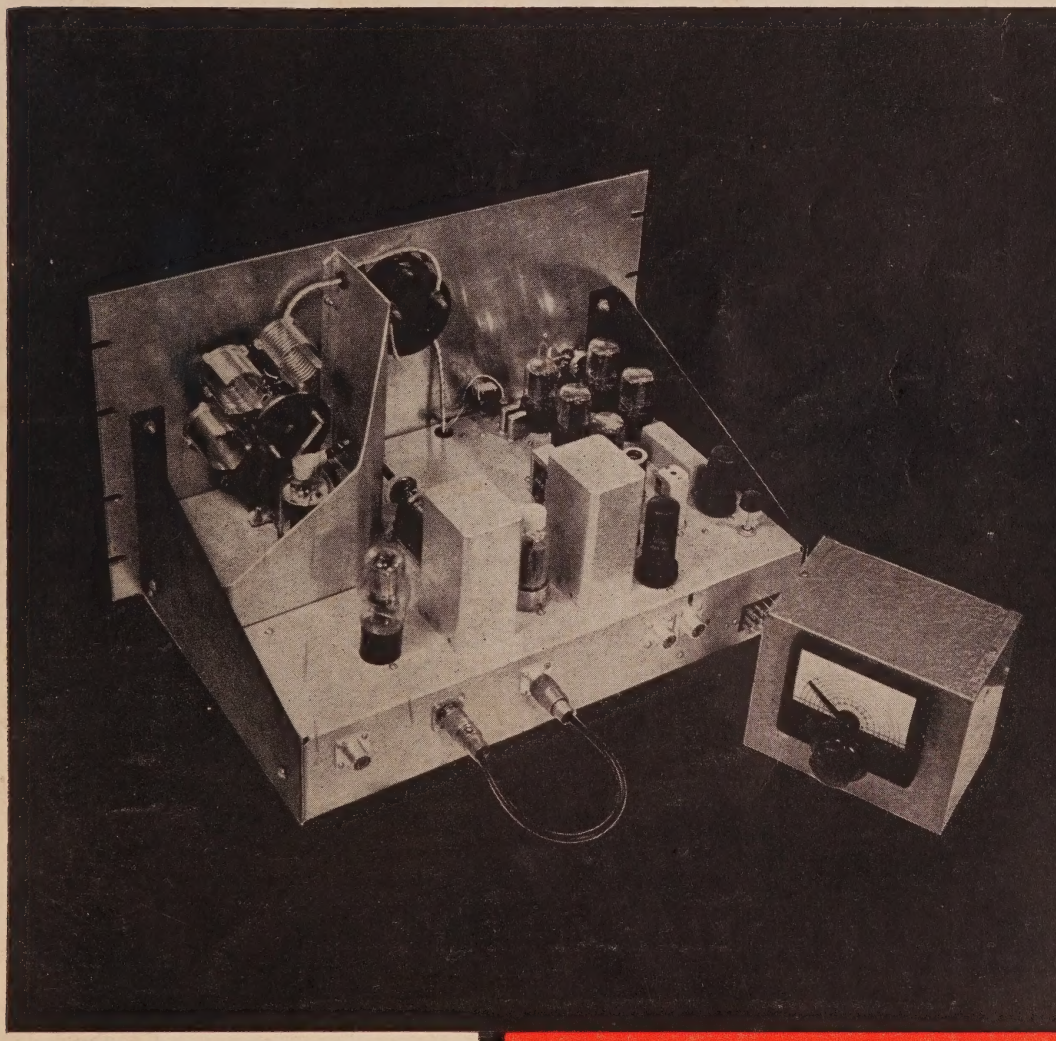
SEPTEMBER
1954
35c

RADIO AMATEURS' JOURNAL

SEP 14 P.M



In This Issue =

Phone Patch and the Law . . Transistors
Class K Modulator . . SX-71 Modification

Collins

75A-3 Receiver

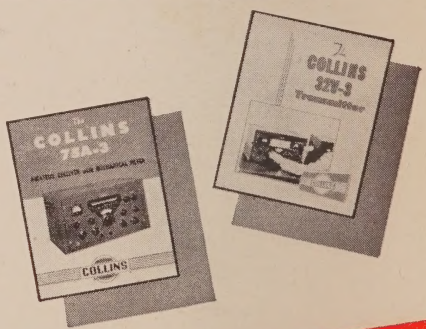
32V-3 Transmitter

Whether your operating taste runs to dx, traffic or rag-chewing, you'll like the convenience of these proven performers. With this popular communications system, you QSY from the high end of 10 to the low end of 80 in a few seconds; just pick your band and set the dials to the desired frequency. With this accurately calibrated pair on your operating table, you don't even have to zero-beat. Want to answer that station on his own frequency? Just set the 32V-3 to the frequency indicated on the 75A-3 — that's all there is to it!

The Collins 75A-3 double-conversion receiver, with its crystal-controlled front end and highly stable low frequency VFO, is like a high frequency crystal-controlled converter working into a very stable low frequency receiver. The high stability and 3.1 kc bandwidth of the 75A-3 make it ideal for AM or single sideband — and 800 cycle and 6 kc bandwidth filters are available as optional accessories. All coils are permeability tuned and have a straight line frequency characteristic, allowing linear dial calibration. Only the band in use is visible on the slide-rule dial. On the vernier dial, each division represents one kc except on the 10 and 11 meter bands, where each dial division represents two kc. This accurate calibration is made possible by the highly stable oscillators in the 75A-3.

The 32V-3 is a VFO controlled band-switching gang-tuned transmitter rated at 160 watts input on CW and 140 watts on Phone. It is thoroughly filtered and shielded to minimize the possibility of TVI.

Fully illustrated booklets describing this popular pair are available at your Collins distributor.



COLLINS RADIO COMPANY

Cedar Rapids, Iowa

261 Madison Ave., NEW YORK 16
1930 Hi-Line Drive, DALLAS 2
2700 W. Olive Ave., BURBANK

Collins Radio Company of Canada, Ltd., 74 Sparks St., OTTAWA, ONTARIO

Announcing THE THIRD ANNUAL

EDISON RADIO AMATEUR AWARD

You are invited by the Award Committee to nominate your candidate for 1954

FOR the third successive year, you have the opportunity to single out for national acclaim someone who has rendered outstanding service while pursuing his hobby, amateur radio.

Only candidates who are nominated by letters from you and others, will be considered by the judges.

Naming the Edison Award winner is a tribute to the efforts of all amateurs in the public interest. By entering a candidate, you help make this tribute possible . . . and can win for yourself an expense-paid trip to the city where the Award will be presented.

Edison Award achievement is exemplified in the work of J. Stan Surber, W9NZZ, last year's winner. Mr. Surber since 1950 has served as a regular message link with hundreds of men on duty at remote Arctic weather stations—has handled, in all, some 20,000 personal communications.

Other new pages of amateur achievement are being written while you read this. Aid in honoring those responsible! Read the rules below . . . select your Edison Award candidate . . . and mail your nominating letter to *Edison Award Committee, Tube Department, General Electric Company, Schenectady 5, N. Y.*

RULES OF THE AWARD

WHO IS ELIGIBLE. Any man or woman holding a radio amateur's license issued by the F.C.C., Washington, D. C., who in 1954 performed a meritorious public service in behalf of an individual or group. The service must have been performed while the candidate was pursuing his hobby as an amateur within the continental limits of the United States.

WINNER OF THE AWARD will receive the Edison trophy in a public ceremony in a centrally located metropolitan city. Expenses of his trip to that city will be paid. As a further token of appreciation, G.E. will present him with a precision timepiece to clock DX. In addition, the person responsible for the nomination of the Award-winning candidate will be invited to attend the presentation ceremony, and his expenses also will be paid.

WHO CAN NOMINATE. Any individual, club, or association familiar with the service performed.

HOW TO NOMINATE. Include in a letter the candidate's name, address, call letters, and a full description of the service performed. Your letter must be postmarked not later than January 3, 1955.

BASIS FOR JUDGING. All entries will be reviewed by a group of distinguished and impartial judges. Their decisions will be based on (1) the greatest benefit to an individual or group, (2) the amount of ingenuity and sacrifice displayed in performing the service. The judges will be:

E. ROLAND HARRIMAN, President, The American Red Cross

VAL PETERSON, Administrator, Federal Civil Defense Administration

EDWARD M. WEBSTER, Commissioner, Federal Communications Commission

GOODWIN L. DOSLAND, President, American Radio Relay League

WINNER WILL BE ANNOUNCED on or before Thomas A. Edison's birthday, February 11, 1955.

Employees of the General Electric Company may nominate candidates for the Edison Radio Amateur Award, but are not permitted to receive the Award.

GENERAL ELECTRIC

166-185

A Change ..for the better

Our CPO-128, CPO-130 and FCC-90 were the best on the market. This did not satisfy us. We're constantly striving for improvement.

● CODE PRACTICE OSCILLATOR AND MONITOR CPO - 128 A

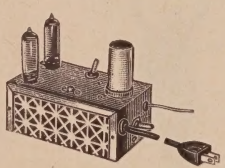
The new improved CPO-128-A now utilizes 2 tubes—50C5 and 35W4. This means you actually get increased output from this really potent CW monitor which is ready to operate at all times.

THE BUD CODEMASTER is a real money saver. No longer do you have to consider your code practice oscillator useless after you have learned the code. A flip of the switch and you have a real good CW monitor. This is a really versatile instrument. It has a 4" built-in permanent magnetic dynamic speaker and will operate up to twenty earphones.

A volume control and pitch control permit adjustments to suit individual requirements. Any number of keys can be connected in parallel to the oscillator for group practice. This unit will operate on 110 volts A.C. or D.C. An external speaker may be plugged in without the use of an output transformer. All controls are placed on the front of the unit and all jacks are in the rear. The unit is 6½" high, 5½" wide and 3½" deep. It is finished in Grey Hammertone enamel with red-lettering.

CPO-128-A .....Amateur Net **$15.75**

Also available in earphone model CPO-130 A at **$14.10**



FREQUENCY CALIBRATOR FCC-90A

The elimination of drift is a vital responsibility of every amateur operator. To comply with Federal Regulations some means of accurately checking transmitter frequency must be available at every "Ham" station. You can avoid a "pink ticket" for off-frequency operation by using the BUD self-powered frequency calibrator. The new improved BUD FCC-90-A also uses 2 tubes—50C5 and 35W4. It consists of a 100 kc crystal oscillator that is completely self-powered and will give 100 kc check points on all bands to 30 megacycles. This enables you to determine the exact band edges.

No extra wiring is required to install this unit. Plug the FCC-90-A into a 110 volt receptacle, connect the pick-up lead to the antenna binding post of the receiver and the unit is ready for operation. An ON-OFF switch and a STANDBY switch are provided.

FCC-90-A .....Amateur Net **$17.25**

See these new BUD products at your distributor today!
Write for copy of New Bud Catalog No. 154

BUD — THE MARK OF PERFECTION

BUD RADIO, INC.

2118 East 55th St. Dept. C Cleveland 3, Ohio

September, 1954
Vol. 10, No. 9

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Technical Consultant

Herbert S. Brier, W9EGQ*
William I. Orr, W6SAI**
Assistant Editors

Our Cover Photo

The cover feature this month is one of the many new pieces of equipment described in great detail in our forthcoming book "Single Sideband Techniques." It is a 75-meter VFO SSB exciter with 35 watts of useful peak output. A Collins mechanical filter is employed in a circuit that enables sideband switching and carrier re-insertion. Receiver anti-trip and automatic voice control (VOX) are two more of the features in this unusual unit. A separate heterodyne unit which is also described in this book will allow the use of this exciter on any band from 10 to 80 meters.

CQ

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** 555 Crestline Drive, Los Angeles 49, Calif.

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Heathkit
GRID DIP METER KIT

MODEL GD-1B

$19.50 Ship. Wt. 4 lbs.

The invaluable instrument for all Hams. Numerous applications such as pretuning, neutralization, locating parasitics, correcting TVI, adjusting antennas, design procedures, etc. Receiver applications include measuring C, L and Q of components—determining RF circuit resonant frequencies.

Covers 80, 40, 20, 11, 10, 6, 2, and 1¼ meter Ham bands. Complete frequency coverage from 2—250 Mc, using ready-wound plug-in coils provided with the kit. Accessory coil kit, Part 341-A at $3.00 extends low frequency range to 350 Kc. Dial correlation curves furnished.

Compact construction, one hand operation, AC transformer operated, variable sensitivity control, thumb wheel drive, and direct reading calibrations. Precalibrated dial with additional blank dials for individual calibration. You'll like the ready convenience and smart appearance of this kit with its baked enamel panel and crackle finish cabinet.

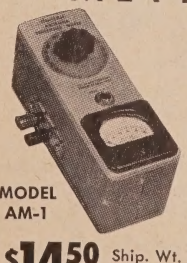
Heathkit
ANTENNA COUPLER KIT

MODEL AC-1

$14.50 Ship. Wt. 4 lbs.

The new Heathkit Antenna Coupler Model AC-1 was specifically designed to operate with the Heathkit Amateur Transmitter and will operate with any transmitter not exceeding 75 watts RF input power. Rugged design has resulted in a sturdy, well shielded unit featuring a copper plated chassis and shield compartment. Coaxial 52 ohm receptacle on the rear of the chassis connects to a three section Pi- type low pass filter with a cut-off frequency of 36 Mc. Tuning network consists of a variable capacitance and tapped inductance in an impedance matching unit. Capacity coupled neon lamp serves as a tuning indicator and will also provide a rough indication of power output.

Heathkit IMPEDANCE METER KIT



MODEL AM-1

$14.50 Ship. Wt. 2 lbs.

The Heathkit Antenna Impedance Meter is basically a resistance type standing wave ratio bridge, with one arm a variable resistance. In this manner it is possible to measure radiation resistance and resonant frequency and antenna transmission line impedance; approximate SWR and optimum receiver input. Use it also as a monitor or as a field strength meter where high sensitivity is not required. Frequency range of the AM-1 is 0–150 Mc and range of impedance measurements 0–600 ohms. The circuit uses a 100 microampere Simpson meter as a sensitive null indicator. Shielded aluminum light weight cabinet. Strong self supporting antenna terminals.

HEATH COMPANY
BENTON HARBOR 6, MICHIGAN

Feenix, Ariz.

Deer Hon. Ed:

You knowing, I thinking Scratchi are getting mello in his old age. Yes indeedy. Why I thinking so? Well, when it are obveeus that reseever are needing Eye-F alinement, are I hurredly pulling out meter, grabbing tooning rench, and lineing up Eye-F coils? Not any more. I wateing for it to get worse. Which it does.

When crisstal ossalaytor are acting up and jumping freakwency, are Scratchi cleening crisstal? Not soes you can noteus it. I just plugging in new crisstal and working on new freakwency. Same thing when toob going bad. Are I driving all over towns trying to trade it with sum other amchoor? Not very often. I just plugging in new second-hand toob and throwing old wun away (after taking base off to saving in case ever be needing it on which to winding selfsame coils).

Or even when noing that rotary beem no longer being in 1/c toon, are I madly climeing up pole with field strength meter on my back, to retooning beem? Hah! Not any more, no indeedy. Hon. Ed., I no what you saying. You saying that Scratchi are just getting plane lazy. That's where you are rong. Scratchi just getting common sense. So what if Eye-F are not in toon—as long as I can heering sumbuddy, I working them. Why cleen the jumpy crisstal—wun freakwency are as good as any. So what if beem are not in toon—sumbuddy will heering me likewise. Like I said, Hon. Ed., I are getting mello.

Several nites ago I are having big old dates with XYL-to-be and after seeing moom pitchure at local flicker house, we driving out to our fayvorit canyun and sitting there looking at moon. Gollies, I thinking, all I reely wanting is to marrying XYL Lil, settling down, going on air each nite for cupple hours, no problums, no hurly-burly. Then later on, having clomp, clomp of little feets in house, and Scratchi are teeching code to kids, so they growing up being 1/c geenyus radio amchoor like Scratchi. That wood be the life, no doutless.

At least, that what I thinking cupple days ago, but since then, and the . . . . but maybe if I starting at beginning be better. One afternoon short times ago I sitting peecefully in shack, tooning across band, listening to pretty see-w seek-yous coming from earfones, and just getting reddy to calling sum

(Continued on page 6)

New Heathkit VFO KIT

MODEL VF-1

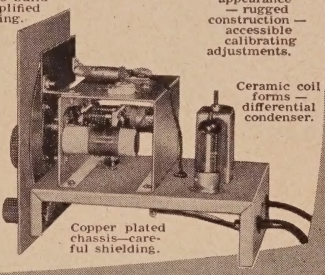
$19.50

Ship. Wt. 7 lbs.

- Smooth acting illuminated and precalibrated dial.
- 6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.
- 7 Band coverage, 160 through 10 meters—10 Volt RF output.
- Copper plated chassis—aluminum cabinet—easy to build—direct keying.

Here is the new Heathkit VFO you have been waiting for. The perfect companion to the Heathkit Model AT-1 Transmitter It has sufficient output to drive any multi-stage transmitter of modern design. A terrific combination of outstanding features at a low kit price. Good mechanical and electrical design insures operating stability. Coils are wound on heavy duty ceramic forms, using Litz or double cellulose wire coated with polystyrene cement. Variable capacitor is of differential type construction, especially designed for maximum bandspread and features ceramic insulation and double bearings.

This kit is furnished with a carefully precalibrated dial which provides well over two feet of calibrated dial scale. Smooth acting vernier reduction drive insures easy tuning and zero beating. Power requirements 6.3 volts AC at .45 amperes and 250 volts DC at 15 mills. Just plug it into the power receptacle provided on the rear of the AT-1 Transmitter Kit. The VFO coaxial output cable terminates in plastic plug to fit standard ½" crystal holder. Construction is simple and wiring is easy.


Open layout,—easy to build — simplified wiring.
Smooth acting illuminated dial drive.
Clean appearance — rugged construction — accessible calibrating adjustments.
Ceramic coil forms — differential condenser.
Copper plated chassis—careful shielding.

Heathkit AMATEUR TRANSMITTER KIT

MODEL AT-1

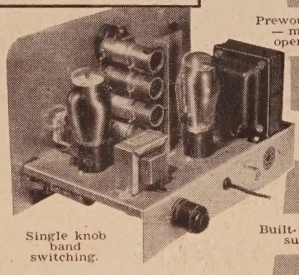
$29.50

Ship. Wt. 16 lbs.

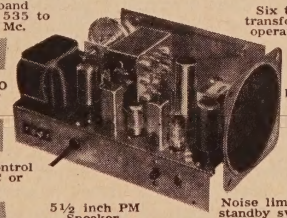
SPECIFICATIONS:

Range 80, 40, 20, 15, 11, 10 meters.
6AG7 .....Oscillator-multiplier.
6L6 .....Amplifier-doubler
5U4G ..... Rectifier.
105-125 Volt A.C. 50-60 cycles 100 watts, Size: 8¼ inch high x 13⅛ inch wide x 7 inch deep.

Here is a major Heathkit addition to the Ham radio field, the AT-1 Transmitter Kit, incorporaring many desirable design features at the lowest possible dollar-per-watts price. Panel mounted crystal socket, stand-by switch, key click filter, A. C. line filtering, good shielding, etc. VFO or crystal excitation—up to 35 watts input. Built-in power supply provides 425 volts at 100 MA. Amazingly low kit price includes all circuit components, tubes, cabinet, punched chassis, and detailed construction manual.

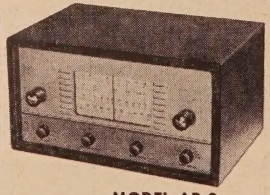


NEW Heathkit COMMUNICATIONS RECEIVER KIT


Four band operation 535 to to 35 Mc.
Six tube transformer operation.
Stable BFO oscillator circuit.
Electrical bandspread and scale.
RF gain control with AVC or MVC.
5½ inch PM Speaker-Headphone Jack.
Noise limiter—standby switch.

SPECIFICATIONS:

Range.....535 Kc to 35 Mc
12BE6 .....Mixer-oscillator
12BA6 .....I. F. Amplifier
12AV6 Detector—AVC—audio
12BA6 ....B. F. O. oscillator
12A6.....Beam power output
5Y3GT .....Rectifier
105-125 volts A. C. 50-60 cycles, 45 watts.



MODEL AR-2

$25.50

Ship. Wt. 12 lbs.

A new Heathkit AR-2 communications receiver. The ideal companion piece for the AT-1 Transmitter. Electrical bandspread scale for tuning and logging convenience. High gain miniature tubes and IF transformers for high sensitivity and good signal to noise ratio. Construct your own Communications Receiver at a very substantial saving. Supplied with all tubes, punched and formed sheet metal parts, speaker, circuit components, and detailed step-by-step construction manual.

CABINET:

Proxylin impregnated fabric covered plywood cabinet. Shipg. weight 5 lbs. Number 91-10, $4.50.

HEATH COMPANY
BENTON HARBOR 6, MICHIGAN

Designed for

Application

The No. 90651

GRID DIP METER

The No. 90651 MILLEN GRIP DIP METER is compact and completely self contained. The AC power supply is of the "transformer" type. The drum dial has seven calibrated uniform length scales from 1.5 MC to 300 MC plus an arbitrary scale for use with the 4 additional inductors available to extend the range to 220 kc. Internal terminal strip permits battery operation for antenna measurement.

JAMES MILLEN MFG. CO., INC.

MAIN OFFICE AND FACTORY

MALDEN

MASSACHUSETTS

(from page 4)

peechy dee-x what rolling in, when suddinly I heering cows bellering like furies. I jumping up, sitting rite down again on acct. earfone cord are reel short, taking off earfones, and running to window. Gollies sakes, I seeing about fifty cows running like madly and hedding rite for house.

I are assuring you, Hon. Ed., this not normal, on acct. we having fences to preventing same. Howsumever, I dashing out just as Hon. Brother Itchi are coming out of house, and together we stopping all of Itchi's cows and getting them herded into pen near barn. Just closing gate when we see what cawsing trubble. Fifteen or twenty kids, dressed in cowboy hats, brite shirts and chaps, twirling lassoes, come riding up on ponies. Sacremento!! Howcomes we having flood of kids on ranch? We stopping cupple of them and asking. They saying they coming from Teddy-Bear Bar-X Dude Ranch cupple miles down road, and they out for afternoon of playing cowboy. Can you imagineing?

Well, it taking us neerly a day to cleening up mess cawsed by cows, and both Itchi and I plenty burned-up. In fack, next day I are just about getting calmed down, and are sitting in shack, looking out window, when suddenly having haloosinayshun. I seeing Man from Mars looking thru window at me! Big space helmet with fancy doo-dads on it, and a face inside. I shaking my hed, and haloosinayshun disapeering. Looking back again, and this time seeing two Mans from Mars looking at me. This time I shaking my hed, but they still there! As I watching them, wun raises his arm, points funny-looking pistul at me, and Whammo!! I falling over backward off chair.

Picking myself up off floor, and deciding I leening back too far in chair and it tipping over. Man from Mars not at window, so maybe it all a dreem. Playing safe, however, I walking outside. Just as I do, five Mans from Mars jumping on me, tying me up, dragging me to tree, propping me against tree, and shooting space-guns at me. When I reelize I not getting hurt, I start to thinking, when suddenly it comes to me. Those kids again!! I ripping off ropes, catching closest Man from Mars, and sure enuf, this is there day to play space-man!! It are all I can do to keep from making it Scratchi day to playing poppa and spanking the bunch of brats.

Next day, getting up early, going out to barn, when remembering kids, so I going out of back door very slowly. Looking around, nobuddy there, so walking slowly out across driveway, looking all around me, when Pzzzztt! a suction-cup arrow are catching me on back of my Hon. Lap. Yep, Hon. Ed., you gessed it—this are there day to playing Indian. Well, enuf are enuf, and then sum, espeshully before they deciding to make it there day to play gangsters, so I calling Teddy-Bear Bar-X Dude Ranch and telling boss there to keeping kids on Hon. Proppity. So, not having more trubble as yet.

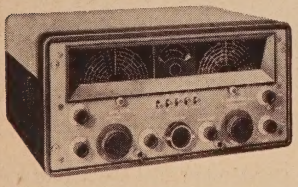
You know this old mello feeling I having? All this stuff about settling down, marrying Lil and heering clomp, clomp of little feets around house? Forgetting it, Hon. Ed. Pertend I not ever saying it. I riting you longer letter on subject only I gotta rush off. My reseever not having the old pep, and I thinking maybe I can adjusting the Eye-F xformers a little bit a peeking them up. It not good to letting thing like that go to far.

Respectively yours,
Hashafisti Scratchi

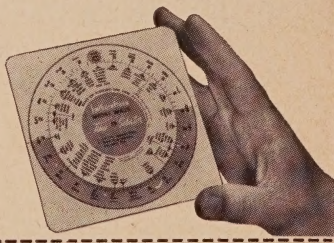
W9WJV beats last year's Field Day record with

hallicrafters

Lawrence T. Fadner, team captain in Chicago's 1954 North Suburban Ham Club ARRL 40 meter CW Field Day bettered the club's last record by nearly 30%.



and Hallicrafters SX-88 is hot news too. More hams are telling each other about this new receiver than about any equipment in years.



Used by 33 governments, sold in 89 countries

hallicrafters

CHICAGO 24, ILLINOIS

MAIL THIS COUPON

FREE—Send me World-wide Time Conversion Dial Calculator and all band frequency allocation chart plus a fund of other handy data.

Name_____

Address_____

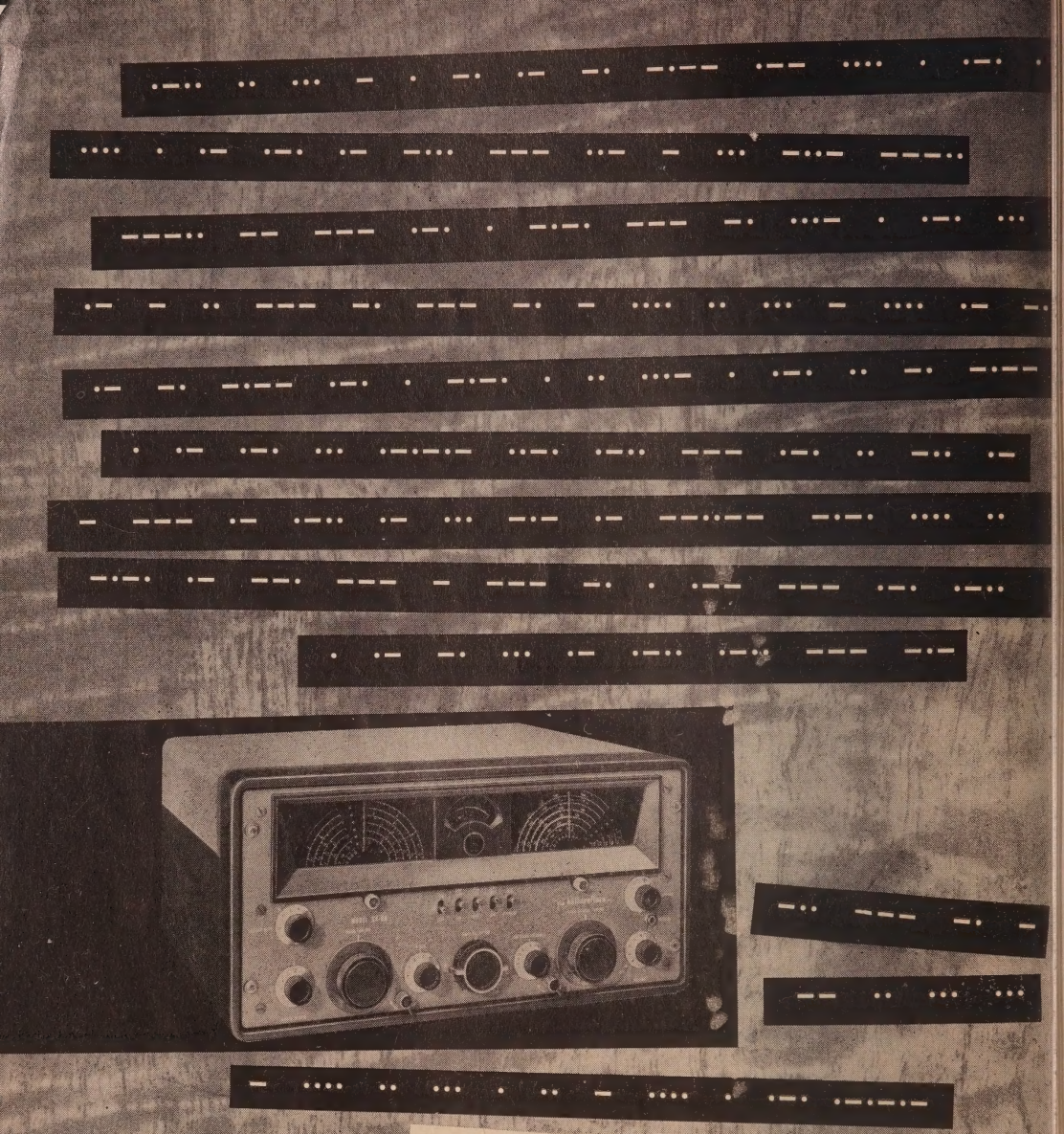
City_____ State_____

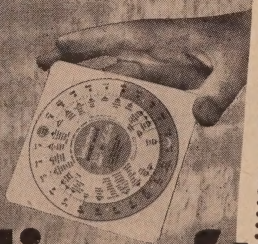
☐ Ham (call letters_____) ☐ Listener

Occupation_____

Hallicrafter equipment I would like to know about:

_____





MAIL THIS COUPON

FREE—Send me World-wide Time Conversion Dial Calculator and all band frequency allocation chart plus a fund of other handy data.

Name_____

Address_____

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CQ BOOKS for HAMS

How to Locate and Eliminate Radio & TV Interference

by Fred D. Rowe

Published by *John F. Rider Publisher, Inc.* (1954), 480 Canal Street, New York 13, N. Y. 101 pages—16 page appendix—4 index, 5½"x8½", $1.80.

This is a book that has been long overdue. It is a concise, readable and factual treatment of every source of TV and radio interference from harmonics to coronas and back again. This one we can highly recommend—even if you only let it sit on the book shelf to impress the neighbor that you have "something" on the subject. The treatment of Ham interference (both BCI and TVI) is intelligent and handled with the knowledge that they don't want to create QRN. Well worth studying—especially those fluorescent lamp radiation curves with a nice peak in the 80-meter band. Yes, you can do something about it, but I'll let author Rowe tell you how. o.p.f.

Subminiaturization Techniques for Low-Frequency Receivers

by Gustave Shapiro

Available from the *Superintendent of Documents, U.S. Government Printing Office*, Washington 25, D.C. 64 pages—44 figures, 8" x 10¼", $0.50.

In the October 1951 issue of *CQ* we discussed the fact that the National Bureau of Standards had taken the familiar ARC-5 receiver series and started a program of miniaturization. The original R-23-A/ARC-5 weighed 8.9 pounds and had a cubic volume of 300 inches. The first step towards miniaturization brought this down to 7.6 pounds and 150 cubic inches (known as the ARR-21). The next step was the reduction of the BC-453 equivalent to 5.3 pounds and 55 cubic inches!

This booklet tells the full interesting story of how it was done—just in case you want to open up that receiver on the desk and try to fit it into the glove compartment of the family chariot. On the other hand, some of these techniques may well find their way into future receiver design. Read this one over and see what you think of them.

Statistical Theory of Extreme Values and Some Practical Applications

by Emil J. Gumbel

Available from the *Superintendent of Documents, U.S. Government Printing Office*, Washington 25, D.C., 52 pages including bibliography and appendix, 8" x 10¼", $0.40.

This recent release from the National Bureau of Standards (Applied Mathematics Series) consists of four lectures delivered by the author. They represent one of the very few places in the English language where the theory and techniques of determining extreme values can be found.

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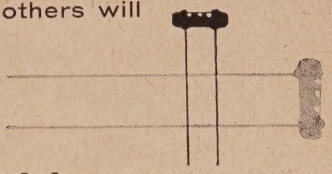

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4X150D	304TL
4X150G	450TH
4X500A	450TL
4X500F	592/3-200A3
4E27A/5-125B	750TL
3K20,000LA, F, K	1000T
3K50,000LA, F, K	1500T
3W5000A3	2000T
3W5000F3	2-25A
3W10,000A3	2-50A
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QUA de CQ

The "Technician Class" on 6 Meters

A few months ago, Jim Price, W5FXN (Austin, Texas), submitted a formal petition to the FCC which proposed granting operating privileges to the "Technician Class" in the 50-54 Mc. amateur band. At the present time this class of license is restricted to those bands above 220 Mc.

W5FXN submitted this petition upon his own initiative and not as a member or representative of any group or organization. In the petition, W5FXN calls attention to the fact that activity in the 6-meter band has deteriorated since the close of *Project RASO*.* He also points out that during the three-year period of *Project RASO* the group of observers cooperating in this project were able to amass considerable interesting and valuable data on propagation and VHF techniques.

The opinion is expressed by W5FXN in this petition that the number of "technicians" would be increased by granting these privileges and that in contrast with the rejection of the idea of granting "Novice" privileges on 6-meters (Docket 10927), the "technicians" are presumed to be as technically competent as "General" class license.

The reporting and evaluation systems used in *Project RASO* made it possible to accurately find the total number of active stations working the 6-meter band. For example, during the first two weeks of June 1950 it was ascertained that 298 stations were active in the States and 29 were active in Canada.** During the same period in 1951, the number had increased to 444 south of the Canadian border and 73 above.† Informal tabulations during 1952 and 1953 indicated that these numbers had dropped drastically. Very few "new" stations appeared on 6-meters after the formal close of *Project RASO*.

Of all the amateur bands, the 6-meter band is the one most likely to be lost to Ham radio within the foreseeable future. The commercial services outside the lower edge of the band cannot help but eye those four megacycles of practically unused frequency spectrum. Numerous remedies to bolster 50-Mc. operation has been suggested and put into practice. Except for *Project RASO* which stimulated 6-meter operation through the period 1949-51 and the minor CD work, there is no concrete evidence that a better solution can be found—other than granting privileges to the "Technicians."

o. p. f.

New Look!

Yes, this issue of *CQ* does have a "new look." It was designed after reading the several hundred letters received in response to our June editorial (on what do you want to see in *CQ*).

For our part, we feel that the most significant change is in the "personalization" of the feature articles and the monthly departments. Readers will also note a new style on our cover and masthead with a shift of editorial positions that moves W6SAI and W9EGQ into "Assistant Editorships" although both of them will continue to work part-time for *CQ* from their respective home QTH's. W2PAU continues as our "Technical Consultant" although he is a full-time employee at the Camden, N.J. RCA plant.

We are also pleased to announce that we have cleared the decks and have lined up for the fall and winter issues the most outstanding group of features that have ever appeared in *CQ*. Next month W6SAI describes a 60-watt transmitter for the semi-home constructor; WØURQ has a 6-band mobile transmitter; W2BFD finishes up his "Junkeyboard" and matrix; while WØGTP starts showing us how to convert the VIKINGS to SSB operation. November starts off with a complete station in a brief case as designed by W6MUR and introduces our electrical "Safety Program" as prepared by W2YRW.

Meanwhile, two staff members are hard at working putting the finishing touches to our forthcoming "Single Sideband Techniques." No "jerry-built" job this book, as can be seen by our cover photo. Planned out for nearly a year, it ties all the facts and figures about SSB together and serves it up in one concise bundle. We are just as proud of it as we are of the "Mobile Handbook."

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* **Project RASO:** From May 1949 until May 1951, the Managing Editor of **CQ** supervised for the Department of the Air Force, Air Force Cambridge Research Laboratories, two research contracts calling for the collection and evaluation of radio amateur observations in the 50-54 Mc. band. Over 500 amateurs throughout the western hemisphere participated in this project with approximately 350 of them being cited by the U.S. Air Force for their contributions to this scientific endeavor. Observers working with **Project RASO** submitted in excess of 125,000 observations which are still being carefully analyzed by the Air Force Cambridge Research Laboratories. An interesting note might be addended at this point to bring out that **Project RASO** was financed by the U.S. Air Force on a non-profit basis. One ARRL Director, two ARRL vice-Directors and seven SCM's were cited by the Air Force for work with **Project RASO.** Paid ARRL employees however could not be encouraged to participate and since the project had not been "thought up" by the "officials" of the ARRL it was never mentioned in **QST.** This is an interesting facet and commentary of what is or is not considered of value to enhance the radio amateur in official circles.

* Contract AF19(122)-242, Interim Report, 15 October 1950.

† Contract AF19(122)-242, Interim Report, 15 November 1951.

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the Phone Patch and the LAW

MAURICE J. HINDIN, W6EUV

W6EUV has been licensed since 1929 and has been spending much of his time keeping local Hams out of legal jams. He works 20 (CW), 2 meter phone (mobile) and is active in RACES and Civil Defense work. W6EUV is legal counsel for the Two Meter and Down Club (L.A.) and the Southern California DX Club. WAC and ORS Mail Address: 6339 Wilshire Blvd., Los Angeles 48, Calif.

The popularity of the phone patch and the increasing publicity regarding their use[1] have given rise to speculation as to the actual legality of their use. Some research into the legal aspects of the use of phone patches indicates that their use does not come within the general scope of the application of legal principles discussed in previously published articles in *CQ*.[2]

A point of departure is made at the outset since it does not appear that there are any FCC restrictions as such on the use of phone patches by amateurs. The absence of a FCC regulation or prohibition does not mean that the amateur can use phone patches without involving himself in serious legal entanglements. A different set of laws and regulations is applicable to the use of phone patches by amateurs. The basic restrictions and prohibitions are found in the laws regulating commercial communication systems and are concerned primarily with the effect of commercial tariff regulations rather than the more well-known fields of law regulating radio communications.

A very brief resume of the applicable field of law is necessary in order to understand how the amateur's use of phone patches is actually regulated. Under the *Communications Act of 1934,* all telephone companies handling interstate calls are required to file tariff schedules with the Federal Communications Commission.[3] When tariff schedules are filed with the Federal Communications Commission by the telephone companies, they become regulations binding upon not only the telephone companies but the general public, and failure to comply with the requirements of the tariff provisions may subject the user to appropriate enforcement proceedings.[4]

Bearing in mind the fact that tariff schedule regulations are binding upon the users of telephone company equipment and that the use of telephone company equipment in violation of a tariff schedule subjects the user to penalties and other liabilities under the *Communications Act of 1934,* it is well to note the provisions of the so-called "foreign attachment" regulations which are found in virtually every telephone company tariff schedule. One typical foreign attachment provision reads as follows:

> "Customers shall not use or permit to be used any electrical or mechanical apparatus or device in connection with service or facilities furnished by the telephone company without the written consent of the telephone company or permit the attachment of advertising devices except upon approval of the telephone

1. Littler, "Phone Patch," CQ, January 1952, p. 17.
   Miedke, "Operation Phone Patch," CQ, December 1952, pp. 21 and 22.
2. Hindin, "Certain Legal Aspects of Amateur Radio," CQ, September 1947, p. 25.
   Hindin, "Skywire and the Law," CQ, December 1951, p. 40.
   Hindin, "Mobileer and the Law," CQ, May 1952, p. 35.
3. 47 U.S.C. section 151, ff.
4. See: sections 401 and 411 of the Communications Act of 1934, as amended.
   47 U.S.C. sections 401 and 411.
   See also: 11 FCC 1033, and Public Notice No. 60591 issued by Federal Communications Commission.
   "On March 28, 1951 the Federal Communications Commission, in Public Notice 60591, used the following language:
   'It should be noted that under the provisions of the Communications Act of 1934, as amended (47 U.S.C. §151 ff.), and Section 203 (47 U.S.C. §2033) thereof in particular, the tariff schedules filed with the Commission by the telephone companies are binding upon those companies and the public, unless and until they are set aside as unlawful by this Commission or a court of competent jurisdiction. Accordingly, failure to use recording devices in compliance with the requirements of such tariff provisions may subject the user to appropriate enforcement proceedings provided for in Section 401 and 411 of the Communications Act (47 U.S.C. §401 and 411), as well as termination of his service by the telephone company.' "

company. In case any instrument, apparatus or device of any kind other than that furnished or approved by the telephone company is attached to or connected with any part of the telephone company's property, the telephone company reserves the right to remove such instrument, apparatus or device or to deny service so long as such instrument, apparatus or device is so attached or connected or to terminate the service."

Another typical foreign attachment provision reads as follows:

"Equipment, apparatus and lines furnished by the telephone company shall be carefully used, and no equipment, apparatus or lines not furnished by the telephone company shall be attached to or used in connection therewith unless specifically authorized in this tariff. When equipment, apparatus or lines furnished by the customer or subscriber are used in connection with equipment, apparatus or lines furnished by the telephone company, the equipment, apparatus and lines furnished by the customer or subscriber must be connected solely with the telephone company's system."

Similar tariff regulations are filed with the Public Utilities Commissions in the various states by telephone companies servicing primarily intra-state communications. The foreign attachment regulations have been uniformly approved by the courts and regulatory commissions.[5] The Federal Communications Commission has authority to limit the operation and application of tariff provisions and has been called upon to pass upon the reasonableness of the foreign attachment provisions of several telephone companies' tariff schedules.[6]

Different Patches

Bearing in mind the foregoing basic legal considerations, it is well now to see just how the use of phone patches is related to existing tariff regulations. Phone patches presently in use appear to fall into three classifications. The first is the inductive type in which there is no direct connection with telephone company lines or instruments. The second is a patch in which a mechanical connection is made to the telephone company equipment but no direct electrical coupling is effected, the coupling being made by induction only. The third type is one in which a direct electrical connection is made with telephone company lines or equipment.

Reduced to its simplest terms, the problem is whether or not a phone patch is a "foreign attachment" within the meaning of the existing tariff regulations. If it is a foreign attachment, then it can only be legally used with the express consent and knowledge of the telephone company which services the station using it. Use of a phone patch without permission may subject the user to penalties, loss of telephone service, additional charges or other liability under sections 401 and 411 of the *Communications Act of 1934*.

Legal Precedents

Two fairly recent cases involving the foreign attachment provisions of telephone company tariff schedules provide some precedent in this connection. They are the *Hush-A-Phone* case and the *Jordaphone* case.[7] In both of these cases the reasonableness of the so-called "foreign attachment" provisions of the tariff schedules was attacked, and in both of these cases the Federal Communications Commission ruled that the foreign attachment provisions were reasonable and enforceable. The *Jordaphone* case is particularly significant because of the broad scope of the language of the particular foreign attachment provision therein involved. That provision read as follows:

"No equipment, apparatus, circuit or device not furnished by the telephone company shall be attached to or connected with the facilities furnished by the telephone company, whether physically, by induction or otherwise, except as provided in this tariff. In case any such unauthorized attachment or connection is made, the telephone company shall have the right to remove or disconnect the same or to suspend the service during the continuance of said attachment or connection or to terminate the service."

In the *Jordaphone* case, the Federal Communications Commission was called upon to consider the reasonableness of the action of the telephone companies in refusing to permit the use of an automatic telephone answering device. The telephone companies refused to permit the use of the device, holding that it was a foreign attachment, within the meaning of the tariff schedule. In this case there was an electrical and mechanical connection between the telephone company's equipment and the telephone answering device in question.[8]

In the *Hush-A-Phone* case, the telephone companies refused to permit the attachment of a mechanical sounding chamber which was attached to the microphone of the telephone. No

5. See **Northeastern Telephone & Telegraph Co. v. Department of Public Utilities**, 262 Mass. 137; 159 N.E. 743.
Gardner v. Providence Telephone Co., 23 R.I. 262; 49 Atl. 1004.
City of Los Angeles v. Southern California Telephone Co., 2 P.U.R. (N.S.) 247.

6. See: FCC Docket No. 6787 re: Use of Recording Devices;
Jordaphone Corporation of America, et al. v. American Telephone & Telegraph Co. et al., Docket No. 9383; **Hush-A-Phone Corporation et al. v. American Telephone & Telegraph Co.**, Docket No. 9189.

7. **Hush-A-Phone Corporation & Harry C. Tuttle v. American Telephone & Telegraph Co.**, FCC Docket No. 9189;
Jordaphone Corporation of America & Mohawk Business Machines Corporation v. American Telephone & Telegraph Co., FCC Docket No. 9383 and Docket No. 9701.

8. The Whole question of the use of recording devices in connection with telephone service is considered in FCC Docket No. 6787.

electrical connection was involved. The Federal Communications Commission also upheld the telephone company's contention that this constituted a foreign attachment and that as applied in this situation, the foreign attachment provisions of the tariff schedules were reasonable.

Based upon these related precedents, it is the author's opinion that the phone patch as commonly used by amateurs is clearly a foreign attachment within the meaning of the tariff regulations if there is a direct electrical or mechanical connection between the phone patch and the telephone lines or instruments. It may be considered a foreign attachment even if there is no direct electrical or mechanical connection but is merely inductively coupled if the tariff provisions of the particular telephone company involved make reference to prohibition of inductively coupled appliances.[9]

Conclusions

In the light of the foregoing discussion, several suggestions might be considered to prevent legal complications where phone patches are used. They are as follows:

1. IF POSSIBLE, GET WRITTEN PERMISSION FROM THE TELEPHONE COMPANY TO USE THE PHONE PATCH.

If the local telephone company does not cooperate, contact the local Civilian Defense Coordinator. The use of phone patches has a distinct Civil Defense use, and the amateur's request, coupled with a recommendation from the local Civilian Defense Coordinator, will probably turn the trick.

2. HAVE THE TELEPHONE COMPANY MAKE THE LINE OUTLET CONNECTION OR INSTALL AN APPROPRIATE LINE OUTLET JACK FOR USE WITH THE PHONE PATCH.

(Incorrect installation procedure which fouled up the telephone company's local circuit has caused trouble in several instances).

3. REQUEST THE LOCAL TELEPHONE COMPANY TO RUN LINE TESTS TO DETERMINE IF THE PATCH AS INSTALLED IS CREATING ANY LINE INTERFERENCE.

On several occasions where this technique was followed, the telephone companies cooperated fully without any question as to the validity of the patch.

4. BE SENSIBLE IN CONNECTION WITH THE USE OF THE PATCH.

The telephone companies are charged by law with maintaining high efficiency in connection with their lines. If the phone patch interferes with their service or is the source of complaints, they will take steps to abolish their use. Clearly they have the power to forbid the use of patches. So far, most telephone companies have cooperated and have been reasonable.

5. IF ALL ELSE FAILS, REQUEST THE TELEPHONE COMPANY TO MAKE AN APPROPRIATE CHARGE FOR INSTALLATION AND USE OF THE PATCH IN ACCORDANCE WITH THEIR TARIFF SCHEDULES.

Since the basic function of the telephone company is to earn a reasonable return on their investment, there should be no logical reason why they would object in the last analysis to render this added service at a moderate fee. It would still be cheaper to pay the telephone company's charges rather than litigate the matter through commissions and courts.

The basic theory underlying the prohibition against foreign attachments is to give the telephone companies the right to control the equipment used in connection with or connected to their service systems. Inherent in the foreign attachment prohibitions is the right of the telephone companies to permit the use of such equipment as in their opinion will not harm or interfere with their existing facilities. Likewise, since the telephone companies themselves prepare and file their tariff schedules, subject of course to direction of the appropriate regulatory commission, specific foreign attachments, such as the phone patch, can be expressly exempted, or in the alternative, authorized subject to a fixed installation charge. Since the use of phone patches definitely contributes to the effectiveness of the amateur radio service, it is entirely foreseeable that tariff regulations in the future may specifically make reference to the use of such patches.

Editor's Note:

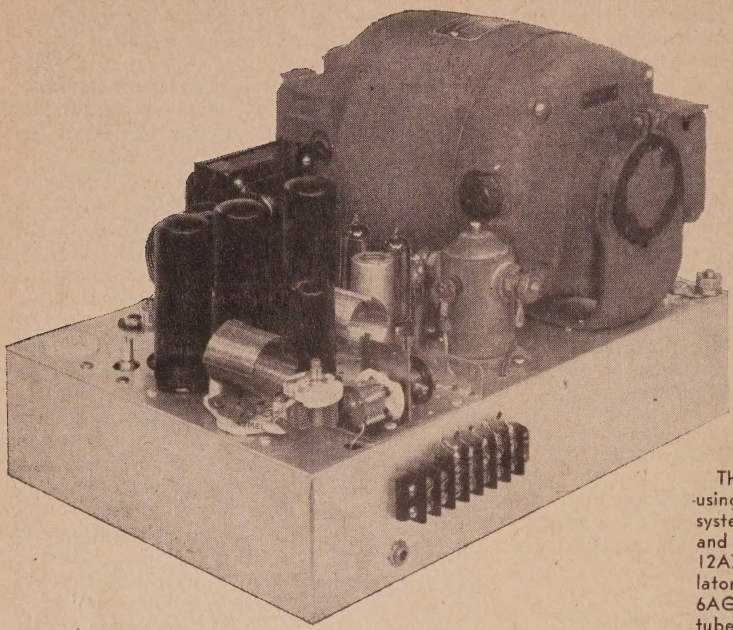
Recent information to hand has added the following points which should be carefully regarded when a phone patch is in operation.

1. It is reported informally that the dialling clicks are not to be put on the air and that at least one "pink" ticket has been issued for this offense. While at first thought this may seem unreasonable, a little reflection will show that a recording of the dial clicks could be used to determine a phone number.

2. On long distance calls, or when a telephone call is placed through an "Operator" be sure that her voice does not go on the air. We are given to understand that the telephone companies do not feel too kindly on this particular point.

3. When the desired party has been contacted on the telephone, be sure to emphasize to them that they are going to be broadcast and that what they may say will be overheard by many people. It is possible that a technicality could be raised if you put a party on the air without their expressed agreement.

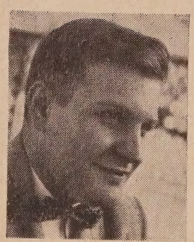
9. The tariff regulation in the **Jordaphone** case specifically made reference to inductively coupled attachments.



The author's mobile transmitter using his "class K" modulation system. Next to the dynamotor and behind the solenoid are the 12AX7, 6AQ5 (2) and 6L6 modulator tubes. The transmitter is a 6AG7 Clapp driving parallel 1614 tubes.

Class K Mobile Modulator

DALE L. HILEMAN, K6DDV, ex-WØMCB



K6DDV has also held W9 and W0 calls since getting his license in 1946 (class A in 1947). Dale likes to work almost any band that will escape the TVI menace. At present he is using this rig on 75 meters. Favorite activity is designing and building new, and sometimes weird, circuits. K6DDV is rapidly becoming a well-known author with a number of technical and humorous stories in print. Employed by Collins Radio Company, 2700 West Olive Ave., Burbank, California in their Publications Section.

One of the most expensive items in a plate modulator is the modulation transformer. You can avoid this expense by using control-grid, screen-grid, or suppressor-grid modulation, but these methods lose out on the basis of carrier efficiency. Or, if you are ambitious, you can go single sideband.

On the other hand, if you have an ordinary filter choke in the junk box, and if you have the required tubes, resistors, and condensers, you can go class K. Class K modulation is by no means revolutionary; it compares in plate efficiency and physical size to a conventional class AB_1 stage. But it uses no modulation transformer.

Class K Modulation

As described in the October, 1953, issue of *CQ*, the class K modulator is a high-level Heising system employing an audio-controlled modulator-screen clamp tube. A filter choke is used in place of a modulation transformer, and the modulator tube is operated class AB_2 The class K system is *not* screen modulation; it is *not* efficiency modulation; it is *not* low-level modulation. It is high-level *plate* modulation. Briefly, this is how it works:

As shown in the schematic, the modulator tube *(V4)* is choke coupled to the plate circuit of the final amplifier. A clamp tube *(V3)* in the modulator screen circuit derives its control voltage from the driver tube *(V2)* output circuit. The modulator tube is virtually zero biased.

The audio is applied simultaneously to the modulator grid and to the grid circuit of clamp tube *V3*. The grid-leak bias developed across *R10* in the clamp-tube grid circuit reduces the average plate current of the clamp tube. The current through *R11* is thus reduced, and the modulator screen voltage rises. Condenser *C8* in the modulator screen circuit prevents the screen voltage from varying at an audio rate but allows it to vary at a syllabic rate. The modulator plate current is therefore a function of the applied audio voltage and is no greater than necessary for a given audio level.

This class K system is similar to the bias-shift system[1] in that the modulator plate dissipation is limited to the value required by the audio level. In the bias-shift system, the modulator plate current is controlled by change of the control-grid bias voltage, while in the class K system, the screen grid is used to control the modulator plate current. The bias-shift system might be applicable to a modulator of this kind, but it requires a fixed-bias supply, a rare commodity in mobile transmitters. The class K system uses no bias supply.

The grid of *V4* is zero biased so that a high modulator plate current can be obtained within a reasonable excursion of the screen voltage. Zero biasing the modulator requires that the driving source supply grid losses on the positive half cycle. In the circuit shown in the schematic *Fig. 1*, a cathode follower is used as a driver to minimize the source impedance offered to the modulator grid. The driver plate current is unfortunately high (about 40 ma.); but if you can think of a more satisfactory method to drive the modulator, more power to you.

The bias developed across 1000-ohm grid resistor *R9* is negligible.

The Transformerless Modulator

The circuit shown in the schematic diagram modulates 50 watts with a single 6L6. A class A 6L6 will normally modulate no more than 20 watts, but used in the class K circuit, the 6L6 delivers over twice its normal rated output; and its plate dissipation is not exceeded. Perhaps this circuit will modulate more than 50 watts, but the transmitter with which I used it would load to only 50 watts.

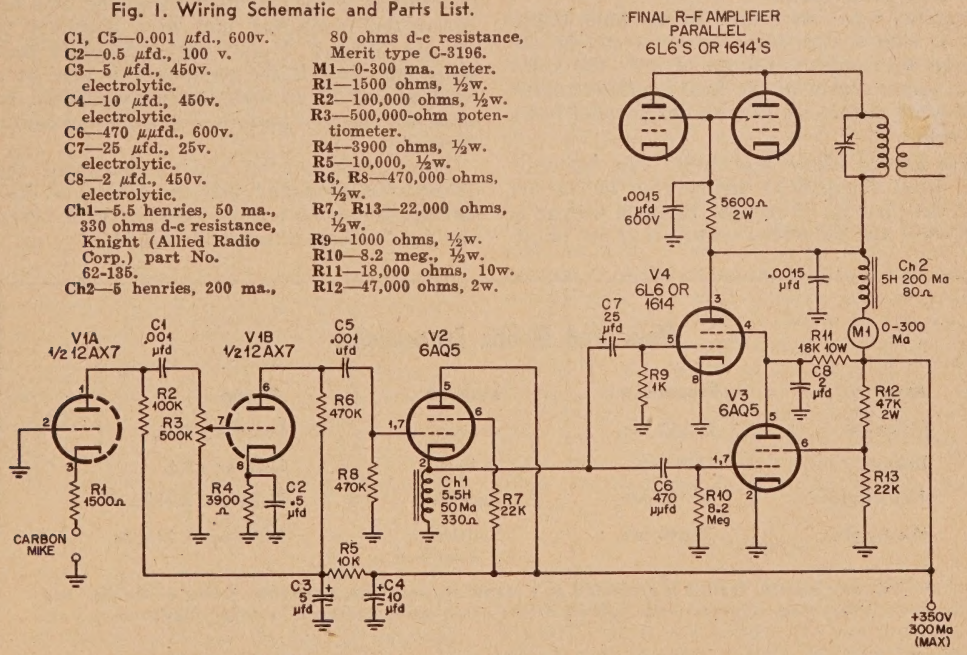
Although it was designed primarily for use with a mobile transmitter, with a few modifications you can use this modulator just as easily in a fixed-station rig. All that is required for operation with a crystal microphone is that the existing microphone circuit be shorted and the crystal microphone be connected from the grid of *V1a* to ground. In this case, a 3.0 megohm resistor should be connected across the microphone circuit. Then if you want better low-frequency response, use a higher capacity for *C1* and *C5*.

The network consisting of *C3*, *R5*, and *C4* is a dynamotor hash filter for the speech amplifier. If a conventional filter network using a filter choke were used, either in a mobile or fixed-station power supply, the *RC* filter net-

1. Orr, "The Bias-Shift Modulator," CQ, April, 1954, p. 33.

Fig. 1. Wiring Schematic and Parts List.

C1, C5—0.001 μfd., 600v.
C2—0.5 μfd., 100 v.
C3—5 μfd., 450v. electrolytic.
C4—10 μfd., 450v. electrolytic.
C6—470 μμfd., 600v.
C7—25 μfd., 25v. electrolytic.
C8—2 μfd., 450v. electrolytic.
Ch1—5.5 henries, 50 ma., 330 ohms d-c resistance, Knight (Allied Radio Corp.) part No. 62-135.
Ch2—5 henries, 200 ma., 80 ohms d-c resistance, Merit type C-3196.
M1—0-300 ma. meter.
R1—1500 ohms, ½w.
R2—100,000 ohms, ½w.
R3—500,000-ohm potentiometer.
R4—3900 ohms, ½w.
R5—10,000, ½w.
R6, R8—470,000 ohms, ½w.
R7, R13—22,000 ohms, ½w.
R9—1000 ohms, ½w.
R10—8.2 meg., ½w.
R11—18,000 ohms, 10w.
R12—47,000 ohms, 2w.



work would probably not be necessary.

The driver tube *(V2)* could have been designed as a conventional grounded-cathode amplifier, transformer coupled to the modulator tube. However, the cost of a driver transformer is greater than the cost of the choke, condenser, and resistor combination. The use of *L/C/R* coupling between the driver and modulator eliminates the need for even one transformer in this modulator.

The bias for cathode follower *(V2)* is provided by the voltage drop across *L1*. Therefore, the d-c resistance of *L1* must be close to the value shown. A plate and screen current of approximately 45 ma. flows through *V2* and *L1*, providing a bias of about 15 volts.

The clamp tube swings the modulator screen voltage between 30 and about 175 volts. The values of *R12* and *R13*, the clamp-tube screen voltage divider, were chosen to provide an adequate modulator screen voltage swing and at the same time a minimum modulator resting plate current.

The modulator plate current swings between 20 ma. and 80—100 ma. The final amplifier plate and screen current is approximately 150 ma. The minimum current indicated by *M1* is therefore 170 ma., and the maximum is about 240 ma.

The modulation choke *(L2)* should have an inductance of at least 5 henries and a current-carrying capacity equal to the final amplifier plate current plus about half the modulator plate current. The lower the resistance of this choke, the less power it will consume in needless heat dissipation.

Parallel tubes were used in the final amplifier so that a high plate current could be obtained with a plate voltage of only 350 volts. The values shown in the final amplifier screen and plate circuit are suitable for parallel 6L6's or 1614's.

For anyone who is interested: The oscillator is a 6AG7 Clapp ECO, the grid on 160 meters and the plate on 75 meters. Its plate voltage is 350 volts, and the screen resistor is 22,000 ohms. The oscillator provides more than enough drive for the final amplifier.

Other Values Not Critical

The values for components used in the modulator are not critical. The placement of components on the transmitter chassis is not critical.

If the modulator is used in a mobile transmitter, the low-voltage d-c conductors from the battery must of course be very heavy, especially if the transmitter is to be located in the trunk compartment and powered by the up-front battery. Standard battery cable is not too heavy.

And if a long microphone cable is used between the trunk compartment and the driver's location, the outer conductor of the cable should be grounded at the *transmitter end only;* otherwise, the ground loop formed between the front and back of the car may introduce dynamotor noise into the microphone circuit.

Performance

Oscilloscope measurements indicate that the circuit provides about 90 per cent modulation for a power input of 50 watts. Without a voltage-dropping network between the modulator and final r-f amplifier, the stage cannot produce 100 per cent modulation; therefore, a kind of clipping is provided, and a very high level of modulation can be obtained without overmodulation.

The purist (the omnipresent critic) will insist that if clipping occurs, even in a mobile transmitter, a low-pass filter should be used between the modulator and final amplifier to prevent splatter. I leave the decision to your judgment. But if the modulator is used at a fixed station in an area heavily populated by other stations, low-pass filtering should of course be used.

Tests conducted on the air indicated the quality was good and that the modulator had the high-frequency response characteristic necessary for "cutting through the QRM."

Monitored Mobile Frequencies

Area	Frequency	Manner	Group
Columbus	26.640 Mc.	various	Columbus Club
Dallas	3995 kc.	various	Caravan Club
Philadelphia	29.493 Mc.	Squelch	Phil-Mont Mobile
Washington	29.640 Mc.	Squelch or Auto-Call	Washington Mobile

This new monthly feature is presented as a reader service. Clip it out when taking a "mobile" trip. Also, make sure your club is listed if they consistently monitor a "mobile" frequency.

Modifying the SX-71

JAMES C. GILFERT, W8KMM

In view of the large number of *Hallicrafters SX-71* receivers in use, we would like to share the results of some experimentation on this receiver. A few simple modifications on the SX-71 may significantly improve its operation on weak signals and heavily QRM-ed bands. The modifications to be described do not require changes which cannot be readily removed if the reader wishes to cross check against original performance.

Audio

The first modification is concerned with tailoring the audio frequency characteristics of the receiver. It was noted that on weak signals, a large amount of noise was heard well below communication audio frequencies. Further, in the heavily QRM-ed bands, stations near the frequency to the one being worked produced low-frequency beat notes which cannot be effectively phased out. This suggested that the audio frequency response should start falling off at about 500 cycles, and should certainly be well attenuated at 200 cycles and lower. An examination of the circuit shows how this can be accomplished with very little effort.

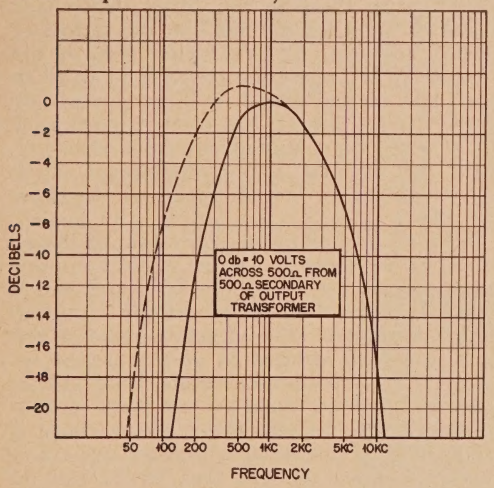


Fig. 2. Audio characteristic of the SX-71. The tone control is set at 10 for minimum treble attenuation. The original response is given in the dashed curve, and the modified response is shown by the solid curve.

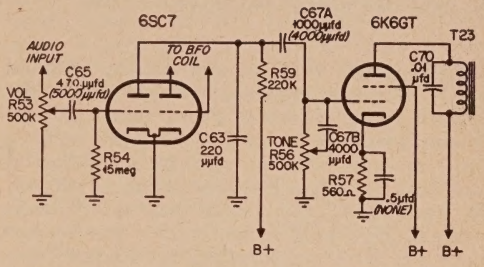


Fig. 1. The audio section of the SX-71. When substitutions are made the original component values are shown in parentheses.

Referring to *Fig. 1,* it is seen that the combination of *C65* (5000 μμfd.) and *R15* (15 megs.) has its 70% voltage point at about two cycles and the combination of *C67A* (4000 μμfd.) and *R56* (0.5 meg.) has its 70% voltage point at about 80 cycles, while the large un-bypassed cathode resistor *R57* (560 ohms) shows no frequency discrimination. The high frequency response of the audio section can be adjusted to the listener's taste with the tone control *C67B* and *R56. Figure 2* (dashed curve) gives the audio response before modification.

In order to reduce low frequency response, the values of *C65* and *C67A* were reduced. After some considerable cut-and-try work, new values of 470 μμfd. for *C65* and 1000 μμfd. for *C67A* were reached. This may seem quite large for *C65,* but it is to be remembered that the high-mu audio triode has a large input capacity because of Miller effect, and values of *C65* much smaller than 470 μμfd. tend to produce undesirable attenuation of the audio at 500 cycles and below. After these changes, a cathode bypass of 0.5 μfd. can be placed across *R57.* This reduces the degenerative feedback in the cathode circuit at higher frequencies and helps give the communication audio frequencies a little more "sock." The audio response after these modifications is given in *Fig. 2 (solid curve).*

The S-Meter

The *S*-meter behavior on the SX-71 was not completely to our liking. It was observed that a signal which was solidly *Q5* was frequently *S0.* If you pass out reports like that, the DX

W8KMM was originally licensed as W3NMB in 1947. At present the author works 40 CW (occasionally), 10 AM (occasionally) and 2 meter FM (frequently). As we might determine from the article itself, W8KMM likes to experiment and make up special projects. Has equipment on all bands from 2 to 160 meters including some mobile. Does his own crystal grinding and etching. Presently employed at the Antenna Laboratory, Columbus, Ohio and working on his Ph.D. at Ohio State University. Home Address: 3288 Walmar Drive Columbus 11, Ohio.

suddenly finds that you are heavily QRM-ed where before you were out in the clear, and the locals find they have to go to dinner, or the phone is ringing, or someone dropped in for a visit. In brief, some changes are mandatory if you want to "win friends and influence people" in Ham radio. Of course, you could always just add five *S*-units to your meter reading, but there are better ways of keeping the other guy happy.

In the SX-71, the *S*-meter is a 5-ma. reverse-reading meter operated by the plate current of the r-f amplifier, a 6BA6. The average plate current of this tube is controlled by the a-v-c voltage developed in one of the 6H6 diode sections. The plate of this diode is coupled through *C49* (25 $\mu\mu$fd.) to the plate of the last i-f amplifier. The negative voltage developed at the diode plate is filtered by *C50* (0.05 μfd.) and *R41* (1 meg.), with *R40* (470 K) serving as the ground return, and it is then applied to the grid return of the r-f and of the first and second i-f amplifiers. The point at which a-v-c voltage starts being developed is determined by the positive voltage, or delay bias, on the cathode of the 6H6. In the original circuit, the delay bias is set at 20 volts, this being determined by the ratio of *R36* (180 K) and *R63* (27 K). The delay bias was reduced, rather arbitrarily, to 3.3 volts, as it produce one *S*-unit deflection on tube noise alone on ten meters in the fully modified receiver. The reduction of delay bias is accomplished very simply by shunting *R63* with a 4.7 K, ½-watt resistor. With the receiver at this stage of modification, if you can hear a carrier, you can also see it on the *S*-meter.

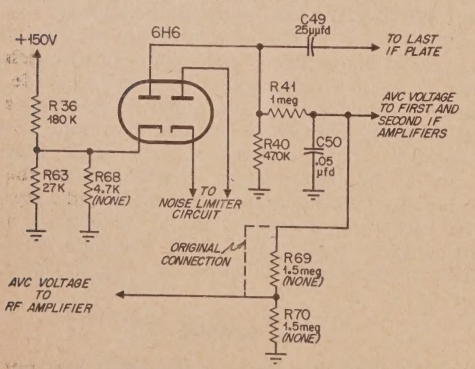


Fig. 3. Modification of the a-v-c circuit for greater S-meter swing on weaker signals. Original values of modified components are shown in parentheses.

If you work only strong stations you can lay down the soldering iron at this point. However, if you like to chase down that choice bit of DX who is just nudging the *S*-meter, there are three further modifications that can be made.

Receiver Gain

First, the gain in the i.f. can be increased appreciably. *R22* (1000 ohms in recent models of the SX-71), the cathode bias resistor in the second i-f amplifier, can be reduced to 270 ohms as it was in early models, increasing the gain of this stage to about three times the original. Also, the first i-f gain can be increased by the substitution of a 6SG7 for the original 6SK7. This change will double the gain of this stage, after the i-f transformers have been retuned to make allowance for the different input and output capacities of the 6SG7. The addition of this tube affords another advantage, to be discussed in the following paragraphs.

There is a final modification which is one of those not-so-obvious finer tricks of the game. An examination of the remote cut-off characteristics of the a-v-c controlled tubes brings up an interesting point. We see that the bias for a transconductance of 40 micromhos is about 25 volts for the 6BA6 in this circuit, while it is about 35 volts for the 6SK7 in the second i-f circuit, and about 50 volts for the 6SK7 in the first i-f circuit, where the screen is returned to the plate supply instead of the regulated 150 volts. If the first i.f. has been changed to a 6SG7 which has a semi-remote cutoff characteristic, the bias for a transconductance of 40 micromhos in the first i.f. circuit will be about 30 volts.

Now let us examine the operation of the receiver on weak signals. As the receiver is tuned to the signal, a-v-c voltage is developed and is applied to the three a-v-c controlled tubes in equal magnitude. The i-f gain is reduced, but the r-f gain is reduced in greater degree because of the difference in remote cut-off characteristics. Between these two amplifier sections there are two mixers (when the receiver is above 5 Mc.), generating a constant amount of noise. The net result is that the r-f gain in front of the mixers is reduced thereby reducing the signal-to-mixer noise ratio, and then the signal *and* noise gain is reduced equally in the i-f amplifier. This makes for good a.v.c. action, but it further reduces the signal-to-noise ratio of weak signals. Ideally then, we should like

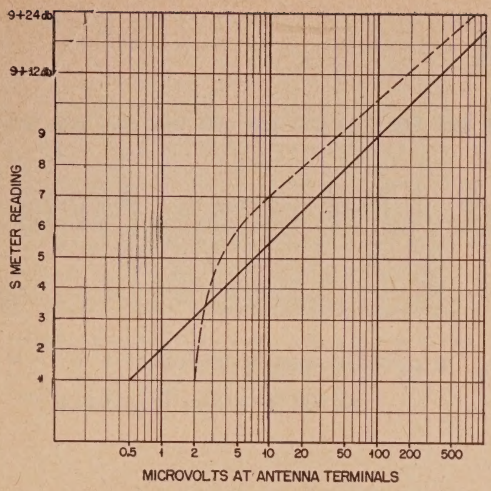


Fig. 5. S-meter readings on the 10-meter band. Unmodified response is shown by the dashed line; modified response by the solid line.

the r-f amplifier to be "wide open" on weak signals, in order to maintain maximum signal-to-mixer noise ratio, but to be a-v-c controlled on strong signals to prevent overloading of the mixer(s) and subsequent cross-modulation. This could be done by the addition of an extra diode section to supply a.v.c. to the r-f amplifier alone, with the diode biased so that a-v-c voltage would begin appearing for perhaps ten microvolts on the antenna terminals.

However, this would take us right back to the beginning, because the *S*-meter is in the r-f amplifier plate circuit, and would not read upscale on weak signals. Further, the switching arrangement on the *BFO* switch and the *Reception* control would be complicated by the addition of the independent a.v.c. line to the r-f stage. If we wanted to make elaborate changes, the extra diode section could be added along with the necessary switch sections, and the *S-meter* could be rewired into the plate of the second i-f amplifier.

It was found that a very acceptable compromise could be reached by providing the r-f stage with a more remote cut-off characteristic than that of the i-f amplifier. This is accomplished by simply forming a two-to-one voltage divider on the a-v-c voltage, allowing the full a.v.c. to operate the i.f., and returning the r-f grid to the midpoint of the divider. This modification is shown schematically in *Fig. 3,* and *Fig. 4* is a photo showing the location of the tie point on which the two resistors are mounted. With the divider wired into the circuit, the full a-v-c voltage required to reduce the 6BA6 transconductance to 40 micromhos is about 50 volts, while the i-f amplifiers had already reached this low value at only 30 volts a.v.c. Thus a good signal-to-noise ratio is maintained on weak signals while the r-f stage is still under adequate a-v-c control.

After these modifications in the r.f. and i.f. circuits, the *S*-meter was checked against a calibrated signal generator The *S*-meter readings for the "before and after" are given in *Fig. 5.* The ultimate sensitivity (on the air) on ten meters was about one-half microvolt well-modulated for a *Q5* signal.

In conclusion, we wish to say that we were very favorably impressed with the SX-71 in its original form and that the modifications outlined above resulted in improved performance during our particular mode of operation.

Comments by the hallicrafters Co., Engineering Dept.

The "Audio" section modifications will greatly impair the audio quality if the receiver is to be used for standard AM or shortwave broadcast reception. In the opinion of the *Engineering Dept.* they should only be installed if the major portion of the operation with this receiver is on CW. The reduction of the a-v-c voltage will improve *S*-meter sensitivity but that then defeats the purpose of the delay which is to maintain maximum receiver sensitivity at extremely low signal levels. The change mentioned in the "Receiver Gain" portion of this story is only necessary because of the a-v-c delay voltage removal.

Increasing the i-f channel amplifier gain does not actually improve the absolute sensitivity of the receiver. It is gain added beyond the point where the signal-to-noise factor is determined.

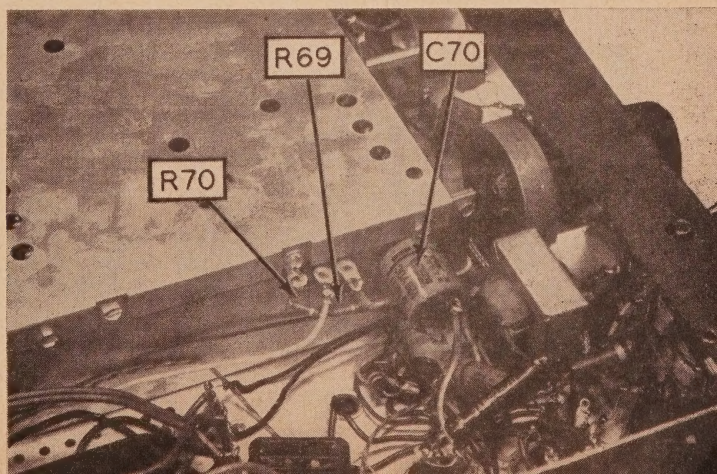
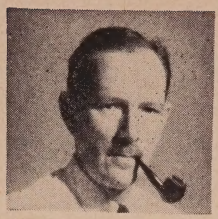


Fig. 4. This under chassis photograph shows the location of C70 and the a-v-c voltage divider. The r-f grid return is also shown coming from the rear of the shielded compartment.

DX and Overseas News



gathered and reported by **R. C. "Dick" Spenceley, KV4AA**

Box 403, St. Thomas, Virgin Islands

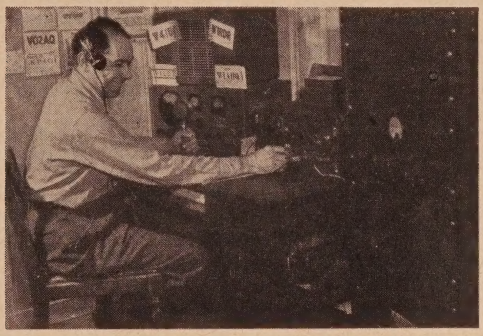
SARAWAK, VS4RO; BRUNEI, VS5RO; BR. NORTH BORNEO, ZC5RO: A recap on Bob's activities at these spots shows that first contacts from VS4RO, June 5, were with KR6OS, JAIAQ and VK2DG. 67 W's were contacted that night the first being W6MX. "Firsts" in other districts were W1ME, W3CRA, W4CEN, W5ASG, W7GBW, W8HGW, W9HUZ, WØELA (appropriately) and KL7PI. First European was G3AAM and first African, ZS2BC. On June 11 VS4RO moved from Kuching to Sibu in Sarawak and operated from the latter spot until June 13. WAC was made with a total of 300 contacts. The next stop, Brunei, is described by Bob as a "wonderful episode in an enchanting country." Here VS5RO was put on the air with the keenly interested assistance of Pengiran Mahomed, Brunei's wireless engineer. Mahomed, who is an excellent CW operator, now plans to put his country permanently on the Ham map with a station bearing the probable call letters of VS5PM. Operations at VS5RO netted some 250 contacts the first being with VK3JJ, closely followed by ZL2BY. The first W was W6DZZ, the first European was OH2RY, the first G was G4CP and the first and only African QSO was VQ2AB. Firsts in other W districts were W2HUQ, W4DQH, W5KC, W7VY, W8ZY, W9NDA and WØAIW. Moving to Jesselton, British North Borneo, ZC5RO was now put on the air. Bob was assisted by his host who is the Postmaster General and ex-ZD2G. The latter intends to go on the air immediately with the call of ZC5G and, altho an old phone man, he will be found on 7032 or 14,064 CW. Low antennas allowed only 160 contacts to be made at ZC5RO. The first W was again W6DZZ. First in other W districts were W2WZ, W3CRA, W4CEN, W7PGX, W8JIN and W9YFV. W3CRA was a strangely reliable nightly QSO but other east coast contacts were few. The nearest thing to a European contact was a weak QRZ? ZS5? from OH2RY. Activity from other spots on Bob's itinerary will be low as these spots are already fairly well represented on the Ham bands, i.e. Singapore, Malaya, Ceylon and India. G2RO's next safari will be a tour of the Pacific islands commencing about October 15. Bob wishes it known that every QSO, without exception, will, in due course, receive his QSL. All will go via bureaus around mid-October. Reply coupons (and dollar bills), tho appreciated, are not necessary.

NAVASSA ISLAND, KC4AB: Don, W4VZQ, has been issued this call and with Bob, W4QCW (and possibly WN4HBC), plans to leave for this QTH on the 1st of August. Activity there will be of seven days duration. A TBS-50-D transmitter running 40 watts on phone and CW will be used. 3.5 thru 21 Mc. will be covered. The main CW frequency will be xtl 14100 and all calls should be of the QLM variety. 14-Mc. phone will be tried on an xtl frequency of 14296. This expedition will go via chartered boat from Santiago de Cuba. QSL's should be sent to W4QCW and contributions to defray partial expenses would be welcomed and result in a direct QSL. All cards received will be answered in any case and should be forthcoming from W4QCW during the last half of September. We trust that this expedition will have been able to avoid the snags and delays which invariably seem to turn up and, as this is read, will have been brought to a successful conclusion. (Word from W1PST/KC4AA advises us that his trip to Navassa should materialize during Nov. or Dec. while Brad, KP4TF, hopes to make a landing there in Oct. or Nov.)

ASCENSION ISLAND, ZD8: Via W3AYS we hear that Mr. T. Sheppard of "Cable and Wireless" on Ascension is now awaiting gear and call sign which will enable him to put this rare spot on the air. (The station signing ZD8V contacted on phone by W4ECI, W5ALA, W6CYI, W7AMX, W7HIA and others is apparently "just one of those things." Beam headings on him were wrong and a cable sent to Ascension by KV4BB, resulted in a reply stating there is no present Ham activity and a person by the name of Garn was unknown.)

W5MIS, Tom Perry, Tulsa, Okla. runs a pair of 813's to a 3 element beam. The exciter is a Collins 310B. Very active in the DX field Tom's country total is in the 240's. (Photo: W5FFW.)

VQ4ERR and his efficient Collins 32V1-75A1 setup. Photo by W3KIF.



Featured DX'er of the Rochester (NY) DX Ass'n for June is W2SNI, Ray Leigh, of Rochester. Ray runs an 813 to 280 watts, pi network output. Phone operation predominates as seen by his stranglehold on the mike. (Photo: RDXA Bulletin.)

Below—This contented gent is none other than Ed Peck, W6LDD. Ed runs a KW on all bands which has resulted in DXCC, WAZ and a present total of 188 countries. (Photo: North California DX'er.)

OH5NK, Ilmari Ahola, of Pyhalto, Finland. Runs 50 watts to a single 807 into a 2 element rotary beam. Ilmari has 152 countries to his credit and recently acquired WAZ No. 297.

SPITZBERGEN, LH2P: LA4ZC reports this station is a member of an expedition and plans called for activity between July 1 and August 20. Phone and CW were to have been used on the following frequencies: 3524, 7021, 14045 and 14025. Times: after 2100 GMT and between 0600 and 0800 GMT. No reports on activity of this station have been received up to July 16. QSL's via N.R.R.L.

CORSICA, F8PW/FC; MONACO, 3A2LA: HB9LA has been issued a license for Corsica and was to have been active from that spot for ten days starting July 29. After that operation he was to spend four days in Monaco with the call of 3A2LA. 300 watts will be run and QSL's go to Box 31, Lausanne, Switzerland, or via the U.S.K.A.

VATICAN CITY, HV1AA: W4YHD informs us that two W phone men arrived in Italy around July 6 with special permission to put HV1AA on the air about mid-July. Nothing has been heard from this station up to July 16 and Italian Hams express considerable doubt that the deal will go through.

IFNI, EA9DD/EA9DE/EA9DF: Cesar, EA9DF, reports that the Ifni expedition, promised for this autumn, will probably take place in December or January. EA9DF continues to be very active from Rio de Oro.

COCOS ISLANDS, ZC2: From VK1HM, via W6EFV, we hear that two new Cocos stations are on the air. They are ZC2AC and ZC2AD.

CRETE, SVØWK/SV9: Fred, SVØWK, plans a Crete trip and will arrive there on July 31 for a five-day stay. A 32V3 transmitter will be used and it is hoped that a CW man will accompany him. If not, the accent will be on phone operation.

NIGERIA, ZD2: Very active from this QTH are ZD2DCP and ZD2HAH. They may be found most any day on the lower half of the 14-Mc. CW band. The only other active ZD2, at present, is ZD2EHW.

GOA, CR8AB: This station has been heard many times around 1400 GMT, 14027, calling CT1CB. CR8AB was heard, by F3TX, QSO'ing LU6DJG, a JA and a 4S7.

GAMBIA, ZD3BFC: G4CP reports that G3BFC, ex-VQ6BFC/MT2BFC, was due to arrive at this much needed QTH around July 1st. (Nothing heard from this one up to July 16.)

DX Notes

VP8AO, QSO'ed by WIRAN gave his name as Ralph and QTH, Grahamland, Antarctica . . . **AC4NC** has been active and was reported as readable from 1515 to 1545 GMT (July 11) by W6NTR. QRG was 14100. SM7QY contacted AC4NC same day . . . **JZØKF** departure for PAØ-land will be in September but he went QRT in July . . . W8NBK reports **MP4QAL** as "active" . . . **PX1AR** recently said QSL via W4BRB, however, Gene knows nothing whatsoever about him . . . **TA3AA/W6QML** returns home in September and TA3AA will be QRT . . . From the "Short Wave Magazine" and G2YS we hear that the French Meteorological Party bound for TROMELIN ISLAND will include a few amateurs, one of the first being FB8BK. There is nothing on the island and the whole set-up will start from scratch. Tromelin will be a new country for DUF and, possibly, for DXCC . . . The ops on **KF8AB**, Fletchers Ice Island, said they expected to be awarded "country status" in due course. Certainly such a remote area should be afforded some recognition. We suggest that any station within a radius of 200 miles from the North Pole whether over, under or on ice should count . . . Doc Markham, of ZS8MK fame, has now shifted from Basutoland to Songea, Tanganyika and will probably be heard shortly as **VQ3MK**.

G3GLO expects to be in Lebanon for five years and should be heard as **OD5BH** . . . G3BFC will probably spend two years as **MP4BFC**, in Bahrein, after a four-month stay in Gambia as **ZD3BFC** . . . **VS1FM, Joe**, is now home and will be heard as **G3JOE** . . . From the "West Gulf DX Bulletin" and **W9HUZ** we hear that Finn, **LB8YB**, departs from Jan Mayen after 950 QSO's mostly with USA (150 with W6). He is stopping in Norway and then on to OX-land . . . **K2GFQ** reports working **LB8ZB, T8C**, on 14072 at 2215 GMT. No QTH but possibly Jan Mayen . . . From **VK3AHH** who handles the WIA "Amateur Radio" DX Column we hear the following: **ZM6AS** recently appeared on 3.5 Mc. CW. **VK1AC** is on all bands 3.5 to 21 on CW and Phone. **ZK2AC** runs skeds at 0700 and 0800 GMT on 7-Mc. CW. VK1's presently active are:

Mawson Base, Antarctica: VK1FG
Heard Island: VK1DY, VK1PG
Macquarie Island: VK1AC, VK1DJ
Cocos Island: VK1BJ, VK1HM

Ian, G3HMB, should be active from Gibraltar as a new ZB2 soon . . . **OQØBH** is a new one in Ruanda-Urundi. He is QRV on 14 Mc. Others are **ØAV, ØDZ** and ØGJ . . . FLASH!—**ZC5G has been heard on 14050.** Q..R..S..! . . . W6WB advises, via VK1DY, that **FB8XX** is off the air due to no power supply. **Also, activity at ZS2MI** is curtailed due to diesel oil shortage . . .

VK/ZL DX Contest 1954

This annual test will be handled by the NZART, Box 489, Wellington, New Zealand.

TIMES: CW, 1000 GMT, Saturday, Oct. 9 to 1000 GMT, Sunday, Oct. 10.
PHONE, 1000 GMT, Saturday, Oct. 2 to 1000 GMT, Sunday, Oct. 3.

SCORING: One point for each contact on each band with any VK/ZL district. Final score equals total contacts multiplied by VK/ZL districts worked on all bands. (ZL1, 2, 3, 4; VK1, 2, 3, 4, 5, 6, 7.)

SERIAL NUMBER EXCHANGE: Six numeral figure, RST plus contact number, i.e.: 001, 002, 003, etc.

AWARDS: An attractive certificate to high scorer in each country (each call area in the U.S.A.).

LOGS: Showing all data, should reach NZART before Jan. 21, 1955.

S.W. LISTENERS SECTION: One point for each VK/ZL heard in contest QSO giving date, time, RST, call of station called and serial number sent by calling station.

New Country

In conformity with DX Committee vote, CQ will now accept the islands of San Andres, Providencia, Roncador Bank and associated islands within the confines of 12 and 14 degrees north latitude and 78 and 82 degrees west longitude as a new country for WAZ/HONOR ROLL credit. These islands are under the administration of Colombia or the joint administration of Colombia and the U.S.A. The Colombian prefix HKØ has been assigned to this area and credit will be given for any contacts after May 1, 1954. (Please re-submit any HKØ's for HONOR ROLL credit.)

DX-ploits

Don Jayme, **PY2CK**, soars to 251 with FB8ZZ, VK1HM and FO8AJ putting him on the No. 3 spot in the HONOR ROLL. The same three stations, on phone, give him 228 our highest country total on phone . . . **W6SN** adds VS4RO and MP4QAH to reach 247 . . . **W6SYG** is also helped by VS4RO to an imposing 243 . . . **W3EVW** also rises to 243 thanks to VR3A . . . George, **VE4RO**, snagged CEØAD to rest on 239 while **W6GDJ** went to 232 with VS4RO . . . **W7DL** comes up to date with CR4AI, FO8AJ, CEØAA, EA9DF, VS4RO, I5LV and VP2DL to reach 232 . . . **W6DLY** ups to 222 with VS4RO. EA9DF and CEØAD . . . **W6CYI** added ZB2A, FO8AJ and VS4RO to hit 220 . . . **W6EFM** is now 218 thanks to VS5RO and EA9DF while **W6BUO** goes to 155 with such as 5A2FA, VS4RO, I1BNU/T, TA3AA and CT3AB . . . **W6ID** rests at 152 with YU3DZ, VS4RO and VR3A . . . **OH5NK** adds VP6LN, EL2X, VQ8AR, VK9GW, MP4ABW, VP8AK and AB1US for 152 . . . **KV4AA** levels with **W8KIA** at 239 with VS4RO and VS5RO (Relax Glenn, I have to take off VQ7 and VQ9 yet—) . . . **W9LNM** ups to 223 with YJ1AA and FO8AJ while Howy, **W2QHH**, goes to 224 with VR3A.

NEW ADDRESSES

CN8HQ—Via W2ZOS.
CR9AI—Box 28, Macao, Asia.
JA1CC—Arika Asano, 257 Eifuku-Cho, Suginami, Tokyo, Japan.
LH2P (Spitzbergen)—Via N.R.R.L.
VP2LA—Box 49, Castries, St. Lucia, BWI.
VP4BN/VP4BC—Jack Bardon, Navy 117, FPO., N.Y.
VS2EB—Mervyn W. Davies, 11-G, Jalan Petri, Johore Bahru, Malaya.
VS1YN—Evan Y. Nepean, Royal Signals, 5 Russels Road, Alexandra, Singapore.
W4AAT (ex-KV4AB)—Willie Plante, 172 Carlisle Dr., Miami Springs, Fla.
W5ETK—John Hall, 8212 Jacobie Blvd., Dallas 17, Tex.
ZC6UNS—Louis, Box 79, Beersheba, Palestine.
(Thanks to West Gulf Bulletin, W5ALA, W5BNO, PAØSPR, W9WWJ)

W5FFW and **W9HUZ** are in a dead heat at 212 with the former adding TI9AA, VQ6UU, FO8AJ, LZ1KPZ, VK9OK, VR3A, YJ1AA and VS4RO while the latter annexed VS2, OD5 and VS9 . . . Ray, **W2BJ**, rises to 210 with FO8AJ, SV2RI and VR3A . . . Chuck, **W4LVV**, adds 13 to rest on 205 while **W4RBQ** makes it 197 with OD5LC . . . **W6LGD** snagged LB8YB, I1BNU/T and JZØKF to reach 165 while Sergio, **CM2SW**, adds 11 including TI9AA, VK9OK, VR3A, EAØAB to rest on 194 . . . Hal, **W6TXL**, upped to 160 with such as VR3D, EA9DF, FO8AJ, VS4RO, VS5RO, I1BNU/T and JZØKF . . . **W2ZVS** nicked ZD9AB and VR3A to reach 165 while Jim, **W5FXN**, went to 169 with VS4RO, VS1YN and VS2EB . . . Ned, **W1RAN**, nabbed CR7IZ and VP8AO for an even 150 . . . Don, **W6AM**, miked with TA3AA for No. 172 on phone while Lew, **WØHX**, jumped his phone total to 143 with 23 new ones which included VQ8AR, ZB2A, ZM6AP, FO8AJ, VQ5EK, VP1AB, ZD4BK and LU4ZO . . . **W8YIN** keyed to 176 with VS5RO . . . **W1HE's** QRP rig nabbed PJ2AR and EA9DF to reach 95 . . . **K6BTE/1**, Port at Warwick, R.I., has 31 countries to show for 30 days operation with a rockbound tt rig. Anyone need R.I.?

W9-DXCC Get-Together

This meet will be held in the Sheraton Hotel, Chicago, on Saturday, Sept. 18. Registration starts at 2 p.m. and turkey dinner at 6:30 p.m. Reservations may be made with W9FKC, W9FID, W9GRV or W9ABA. Five dollars covers all costs. The meeting is open to all DXCC holders.

Lloyd, **DL4ZC** (W4VE), pulled an 85-minute WAC on June 20 with LU3DAB, MP4BBE, ST2NG, W6DFY, DU1NL and OH5OP. This is not as good as the 31-minute WAC he made from JA2KG in 1949 but conditions seem to be looking up . . . **FO8AD** and **OD5AB** have been maintaining daily skeds on the 14-Mc. DX phone band with only a few misses since December 1953. Times are between 0500 and 0630 GMT. Beam headings in Lebanon were SSE changing to NNE by March. OD5AB runs 100 watts to a three-element beam while the rig at FO8AD has 807's parallel and 375 volts on the plates . . . Paul, **K2GFQ**, is up to 132 with such as VK1AC, YS1O, VR3A, FY7YC, LZ1KPZ and VQ4CF. K2GFQ is ex-W6JKH . . . **W9WWJ's** VIKING II has run up 43 countries which include OX3BD, JA1CC, VK3JJ and OE13JR . . . John, **W3UXX**, is up to 44 with such as 9S4AD, VP6GT, YU3GP, ST2NW and FA8DA . . . **W5UUK** reaches 96 with CT3AB, KAØIJ and CEØAD thanks to new 2-element beam . . . **ZM6AI** was worked by W2ESO, 7021, 0950 GMT . . . Fred, **W5AVF**, added CEØAD for No. 147 . . . **W8JGU** rests on 149 with VS5RO and HKØJH . . . **K2DIX** has 50 countries to show for 6 months of operation . . . No. 100 for **G3HSL** was ZD2DCP . . . Gene, **W4BRB**, went to 110 on 3.5 Mc. with FO8AJ. He now holds WAA certificate No. 1 for eighty meters.

Du Bamboo Curtain Lifted

The Philippine Amateur Radio Association advises that, after a four-year DX blackout, restrictions have been lifted and DU Hams may contact the following countries: U.S.A., Nationalist China, Cuba, Dominican Republic, Ecuador, France, Greece, India, Indonesia, Italy, Pakistan, Spain, Thailand and Turkey. More countries will be added shortly.

Here And There

Bob, K2GMO, now keys from **DL4XP** . . . Tom, **TI2TG**, departs for W6-land on August 13. This will leave a considerable gap in the Central American ozone . . . **W8DUS** is setting up a 120 foot tower . . . **YJ1AA** is on Tuwa island and fairly active . . . Willie, ex-KV4AB, is now **W4AAT** in Miami. See QTH's . . . **EL2L** is Sam Butler in Monrovia . . . Jim, **G6ZO**, visited ST2, VQ4 and ET3 in recent trip. He advises there is no present activity in Ethiopia . . . Bill, KH6VP/VR4, is **W4KN** . . . Ginny, the better half of the TI2BX combo, progresses towards her MM certificate on 21 phone . . . The way these misguided phonies are showing up these days someone may start a "pirate DXCC" (I am up to about 35) the prize being a licence to pick your own call) . . . **KP4WD** and xyl dropped in on VE3IG . . . Anyone know the whereabouts of **VR1C**, vintage '50, for W7KVC? . . . We hear that W9NDA handles QSL's for YJ1AA. True? . . . ZC6UNS was worked by **PAØSPR** on 14040 T7C. See QTH's . . .

Honor Roll Deletions

Due to the ST2UU hoax it is our unhappy job to delete the following contacts from all HONOR ROLL listings: CR7UU, FB8UU, VQ7UU, VQ9UU, I5UU, VS9UU, FF8UU, VQ6UU, FL8UU, 4W1UU and HZ1UU.

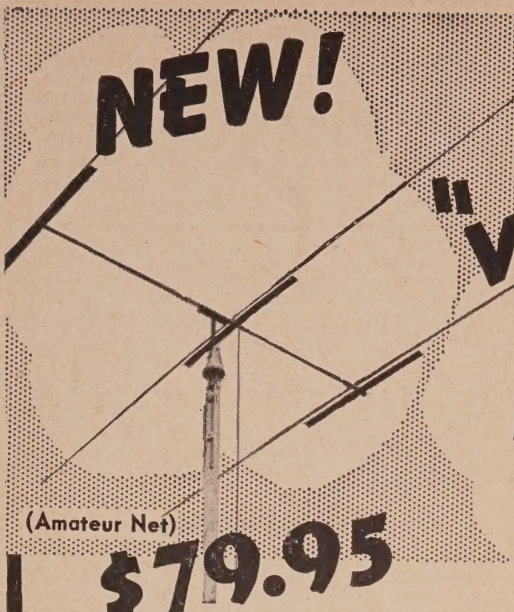
Jack, W4RHC, now mikes from **VP4BN**. xyl Claire, W4TVT, is VP4BC. As the age limit for VP4 licenses is 21 the Jr. op, W4TVU, cannot obtain his. See QTH's . . . Jim, **YN1AA**, visited W8BUM in June. YN1AA was shut down for indefinite period on April 3 . . . Capt. Bill Johnson, **W2UKS/MM**, is QRV for MM QSO's on 10-20-40 and 75. He is 2nd radio officer on the Great Lakes cruise ship SS NORTH AMERICAN . . . KV4AA logged visits from **W2OHF**, **W4ZHL** and **W2CAA** . . . **EA6UU/MM**, Pedro, is on the SS VENDAVAL .

Chas, **VP7NM**, says VP7SL is a pirate which he hopes to locate shortly . . . Wendell, **W6FSJ**, planned two-week business trip to South America in August. In spare time he hopes to visit several DX stations . . . **W6DE** is back on after a two-year layoff . . . The raft LEHI left W6-land bound for Hawaii on July 10. Aboard was Don Smith, W6KAR/MM. Equipment consisted of a Johnson RANGER, **TRANSOCEANIC** receiver and 450-watt gas generator. The first day out the rig got water soaked and Don was only able to put it on 3900-kc. phone. After covering some 300 miles rough seas split a seam in the bow. A distress signal was sent out and the crew were picked up by a San Francisco bound banana boat on July 16.

John Hall, **W5ETK**, now settles down for some home Hamming after stints at W1JSV, D4ATG, DL4TG, FA8DX and SVØWQ. See QTH's . . . Was **KS4AS**, of

(Continued on page 50)

NEW! The MOSLEY original design "VEST POCKET" BEAM ANTENNAS



(Amateur Net)

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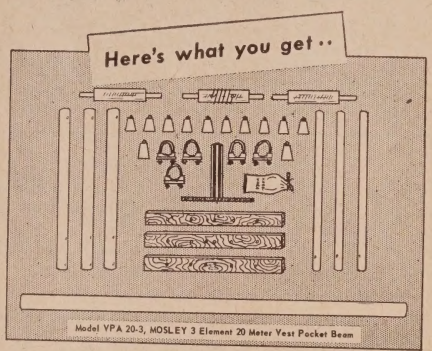
Model VPA 20-3

(OTHER MODELS LISTED BELOW)

- Pre-tuned!
- Ham Proved Performance!
- Quick Assembly!



The MOSLEY V–P Beam is complete ... ready to assemble in 30 minutes, or less, and mount on your rotor.

All parts designed for heavy duty. Aluminum element sections pre-cut, pre-drilled, pre-tuned – color coded! Husky 3" ceramic insulators! Varnished redwood element supports! All metallic hardware non-ferrous or plated! Aluminized steel rotor plate and stub mast! Sturdy, one-piece aluminum boom! Detailed, easy-to-follow assembly instructions!

VPA 20-2, *2 Element 20 Meter Beam.*
Amateur Net $55.95

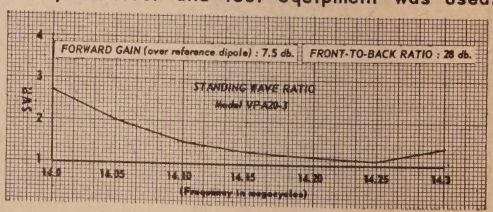
VPA 40-2, *2 Element 40 Meter Beam.*
(Price to be announced)
Write for full details

Here is the *Original Design* "Vest Pocket Beam" – the amazingly efficient miniaturized beam designed by WØVZC and WØQFG and described in May '54 QST.

It's the Beam so widely discussed and praised by Hams, the world over ... and it's available now, Factory Made and Factory Tuned; ready to give you more solid QSO's – more consistent DX!

Typical Performance Data

Performance figures achieved with production model VPA 20-3, 3 element beam, in typical house-top installation. Popular commercially built transmitter, receiver and test equipment was used.



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Dept. H-2

the Novice Shack

Conducted by

Herbert "Herb" S. Brier, W9EGQ

385 Johnson Street, Gary 3, Indiana

Our topic of discussion this month will be antenna transmission lines.

Basically a transmission line consists of two conductors carrying radio-frequency energy from a generator (transmitter) to a load (antenna). Such a line is prevented from acting as an antenna by spacing the conductors very closely together and feeding equal but out-of-phase currents into each one. The fields around the conductors then cancel almost completely, preventing radiation. Slightly different is the coaxial line, in which one conductor is a hollow metallic tube surrounding the other conductor. In it, the r-f energy is kept inside the line by the outer conductor acting as an r-f tight shield.

Basic Theory

Figure 1 represents an infinitely-long transmission line, a battery and a switch. Instead of thinking of the line as a single long line, think of it as an infinite number of infinitesimally-short lines connected in series. Any conductor always has some self inductance, and between two conductors, there is always capacity; therefore, this is true of our line segments.

Upon closing the switch, a surge of current flows from the generator into the capacity of the first line segment. Its value will depend upon the generator

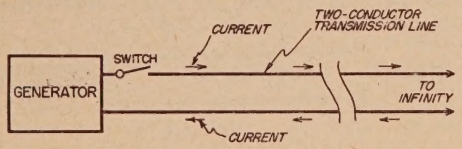


Fig. 1. Sketch to illustrate how the surge impedance of an r-f transmission line is developed as described in the accompanying text.

voltage and the impedance of the segment's inductance and capacity in series. Now, the instant that this capacity becomes charged, its voltage pushes current into the second line segment, and so on, with the generator constantly replacing the current that is passing down the line.

As long as this bucket-brigade action continues, the transmission line "looks like" a pure resistance to the generator, because the current fed into the line never returns. In ohms, this resistance is equal to the generator voltage divided by the current. In fact, we could chop off the transmission line anywhere along its length and connect an actual resistance of the same value across the line, without the generator knowing the difference, because the resistor will consume the power that would otherwise flow forever down our never-ending line.

The impedance defined in the above manner is called the *surge impedance* or *characteristic impedance* of the line. As will become apparent a little later, it has a great deal to do with how a line performs. The area of the conductors, their spacing, type of construction, and the type and quantity of insulating material used determine *surge impedance*. Lines in common use vary between 50 and 600 ohms, and insulation is generally air or polyethylene, both very good.

Air-insulated lines are spaced by means of low-loss spreaders as far apart as practical. But the polyethylene types normally have a solid wall of this material between the conductors. "Air" lines have lower losses than other types, but are more difficult to install. The two conductors must be uniformly spaced from all nearby objects, to prevent unbalance that will cause the line to radiate. Also, the spacing between conductors must be kept equal to avoid upsetting the line impedance. In contrast, almost anything within reason goes when installing polyethylene lines, especially the coaxial types.

Getting back to our theoretical discussion, the transmission line of *Fig. 2* will still "look like" a pure resistance equal to its surge impedance, even if a radio-frequency generator is substituted for the d-c generator. However, the current and voltage distribution on it will naturally follow alternating-current laws.

Assuming that the line is 300 meters long and that 4000-kc. energy is being fed into it, *Fig. 2* shows the instantaneous current and voltage distribution. Electricity travels 300,000,000 meters per second; therefore, it will travel the length of the line in one microsecond. Also, as a 4000-kc. wave will travel 75 meters during one complete cycle, the line will accommodate four complete cycles simultaneously. At 4000 kc., therefore, the line is four wavelengths long. In contrast, it will be ten wavelengths long at 10,000 kc., but only one wavelength long at 1,000 kc.

The *sine* curves along the two conductors are exact duplicates of each other in reverse, to indicate that the current flowing in one direction on one conductor is always balanced by an equal current flowing in the opposite direction on the other one. Do not let them create a hazy impression that radio-frequency energy flows along a transmission line in the manner of an inebriated man walking a straight line from one tavern to the next.

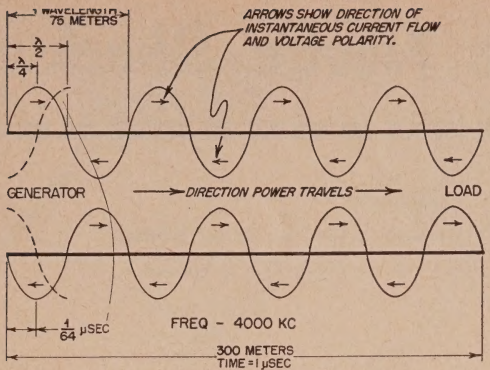

1 WAVELENGTH 75 METERS
λ/2
λ/4
ARROWS SHOW DIRECTION OF INSTANTANEOUS CURRENT FLOW AND VOLTAGE POLARITY.
GENERATOR
DIRECTION POWER TRAVELS
LOAD
1/64 μSEC
FREQ - 4000 KC
300 METERS
TIME = 1 μSEC
DASHED CURVES SHOW HOW CURRENT MAXIMUMS AND MINIMUMS WILL REVERSE POSITIONS ON THE LINE 1/4 CYCLE (1/64 μSEC) LATER.

Fig. 2. Current distribution on a perfectly-matched transmission line fed with radio-frequency energy. The line is assumed to be 300 meters long and fed with 4000-kc. (75-meter) energy. Study this diagram carefully while reading text.

One-sixteenth of a microsecond after the current and voltage distribution on the line was as shown in the figure, the entire energy wave will have travelled ¼ cycle to the right. As shown by the dashed curve, the points carrying maximum energy now will be carrying minimum energy. In other words, the wave goes through its complete range of values at any point on the line during each cycle. Therefore, radio-frequency meters placed any place along the line will read the same quantities.

Many readers who have studied *Fig. 2* closely, are probably asking themselves the following question about now: "How does the current ever get beyond the first section of the transmission line, if it flows up the line for one half cycle and then turns around and flows down the line the next half cycle?"

The seeming paradox can be understood by considering a revolving wheel with a mark on its rim. When the mark is above the axis of the wheel, both are travelling in the same direction. But when it drops below this level, it and the wheel axis are actually moving in opposite directions. Tracing the path followed by the mark as the rim of the wheel moves forward will produce a curve exactly like those in *Fig. 2*. Now consider how the pistons of a locomotive, which move back and forth, deliver power to the driving wheels.

In mathematical style, we can consider each forward and reverse half cycle of current as a vector of force, driving a rotating field of power. This field moves forward one wavelength per revolution. Each field in the train is propelled by the vector generated by the field behind it.

Unmatched Transmission Lines

For obvious reasons, a transmission line feeding a load equal to its **surge impedance** is said to be "matched" to its load. However, it is not always easy to obtain a perfect match when an actual antenna is the load.

Fortunately, a 2-to-1 (generally shown in **CQ** as 2:1) mismatch is a loss of an insignificant amount, and a far greater mismatch is not necessarily fatal. It depends upon the losses in the line when perfectly matched whether a given mismatch increases them too much to be tolerated. A few examples, based upon conditions met with in actual antenna installations will illustrate these facts.

Assume that you wish to operate in the 3.5-Mc. and 7-Mc. amateur bands and can put up a ½-wavelength (130 foot) antenna, 30 feet high for the lower frequency. The antenna can be most-conveniently fed in the center, and it will require about 100 feet of transmission line to reach from the antenna to the transmitter. You have a choice of using 53-ohm RG-58/U coaxial cable or 300-ohm "ribbon." Which should you choose? To show the effects of a mismatched line on the current and voltage distribution, we will assume that your transmitter operates at 75-watts input and will deliver about 50 watts output.

At 3.5 Mc., the center impedance of the antenna will be about 30 ohms (less than the generally-accepted 70-75 ohm figure, because the antenna is low in height in terms of wavelength). At 7 Mc., where it will be operating as two ½-wave antennas in-phase, the impedance will be about 3000 ohms. From a table in the antenna chapter of the ARRL Handbook, we find that RG-58/U has rated losses of 0.53 db. and 0.8 db. per 100 feet at 3.5 Mc. and 7 Mc., respectively, when perfectly matched, while 300-ohm line has losses of 0.18 db. and 0.3 db. under the same conditions. Let's investigate the second line first.

Obviously, to feed 50 watts into these different values of resistance will require the following voltage/current relationships: 300 ohms——122 volts @ 0.4 amperes; 30 ohms——39 volts @ 1.3 amperes; 3000 ohms——390 volts @ 0.13 amperes. Also the ratio between 300 ohms and either 30 or 3000 ohms is 10 to 1.

Operating a transmission line into a mismatched load results in only part of the power fed into it being accepted by the load the first "pass." The rest is reflected back down the line as "negative power" to the generator terminals, where it modifies the effective line impedance. This necessitates changing the coupling between the line and generator to put the desired amount of power into the load.

Because the incoming and returning waves of power flow simultaneously in opposite directions at the same speed, they alternately oppose and reinforce each other along the line. When the load impedance is less than the line impedance, at a point exactly ¼ wavelength back from the load, the voltage waves will exactly reinforce each other and the current waves will oppose each other.

If the load had not accepted any power from the line, the voltage would be theoretically infinite and the current theoretically zero, equivalent to infinite impedance, at this point. But as it did accept power, dividing the voltage by the current reveals that the impedance is actually equal to the line impedance multiplied by the ratio of the line-to-load impedance.

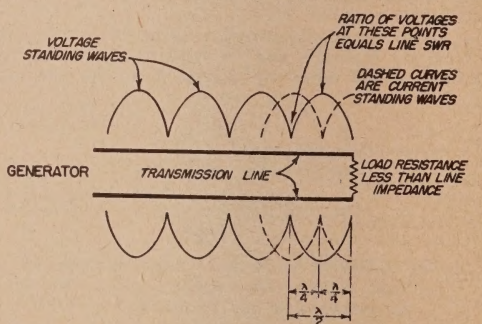


Fig. 3. Typical voltage standing waves on a mismatched transmission line. Load impedance, which is usually an antenna, is assumed to be lower than line surge impedance. If it were higher, positions of maximums and minimums would be reversed. Current is minimum when voltage is maximum (dashed curve).

Another quarter-wavelength back from this point, conditions will be reversed. Current will be high and voltage will be low. They will, in fact, be exactly the same as at the load. Then in each additional half wavelength of line length, these maxima and minima will repeat

(Continued on page 61)

the YL's Frequency

Monitored by

Louisa B. Sando, WOSCF

Towaoc, Colorado

A big item on the agenda for many YLs was Field Day. At least one group of gals went all out for the occasion, the Two Meter Net of the *Los Angeles YLRC*. With the help of W6SHR, Lorraine, at Wrightwood, they chose 8000-ft. Holiday Peak in the Blue Ridge Mountains, about a hundred miles east of Los Angeles. The location was provided with a small stone building containing a couple of bunk beds and a pot-belly stove—no water and no electricity. Ideal as the spot seemed, when F-day arrived many difficulties arose, but "*W6 M*any *W*omen *O*perators" went on the air on schedule.

Seven YLs kept W6MWO (originally assigned to Helen Cook, now a *Silent Key*) on the air for 24 hours, racking up over 100 contacts on 2 meters, 100 or more on 75 and over 50 on 20 meters, all with power below 100 watts. The YLs were W6QGX, Harryette; W6DXI, Gladys; W6CEE, Vada; W6JZA, Elsa; W6WRT, Ruby; K6ANG, Billie, and K6ACF, Rosemary. The girls were grateful for helping hands from the OMs, but they did much of the work themselves. Elsa, W6JZA, brought the little prefabricated "shack" from which she operated, and put it up all by herself. They all helped string up antennas and feeders. Since Forestry regulations specified "no refueling while engine running," the generator sputtered and stopped about every 3½ hours and the gals would make a mad rush to refill it.

One unhappy incident was the loss of two hours operating time Sunday a.m. when an 810 tube went out. But this was made up for by the thrill the girls had when Harryette, W6QGX, worked W4DEE, Beulah, former L.A. club member, on 20 meters, SSB. All the YLs agreed they had a wonderful time. Our thanks to W6LBO, Mary, and W6WRT, Ruby, for sharing it with us, and to the latter for the photos of the girls in action.

Acapulco Calling

Another big event in which many more YLs would have liked to participate was the LMRE convention at Acapulco during the latter part of May. But at least four YLs from the U.S.A. found themselves enraptured by the exotic beauty of Mexico in addition to taking in the convention. Making the trip from California via the Mexican Airlines were **W6DXI**, Gladys; **KN6EJE**, Frances, and **W6LBO**, Mary, all of the Los Angeles YLRC. **W9MMO**, Lillian, drove from Wisconsin with her OM, XE1BT, and youngsters.

W6LBO reports that the YLs especially enjoyed the two picnic luncheons at the beach with typical Mexican food, the boat ride about Acapulco harbor, the dinner dance and other entertainment thoughtfully planned by the LMRE committee. Mrs. Polak, XYL of the LMRE vice president, XE1VA, was most cordial, introducing the YLs and bargaining for the "Gringas" in the market.

Language difficulties prevented meeting all the Mexican YLs, but two of the girls especially remembered are **Maria, XE1VS, and XE1PT**, with whom W6DXI hopes to hold skeds. XE1VA adds this list of XE YLs who attended: XE1VD, Ines; XE1BQ, Dolores; XE1GE, Agnes; XE1MM, Marina; XE1IM, Beatriz, and XE2MA, Diana.

Though they didn't actually get to Acapulco, W6NAZ and OM, W6MSC, drove as far as Mexico City at the time of the Convention and met many gracious XE Hams along the way. When the Conns crossed the border at El Paso, Lenore became XEØNAZ in a blaze of glory. Apparently being one of the first YL XEØs made her just a little more desirable than a plain W6!

As well as working many XEs, Lenore had the fun of keeping twice-daily skeds with W6UHA, Maxine, back home, with nearly perfect conditions for all of the three weeks of their trip. One day when Maxine was conducting the YL net on 20 meters she asked the gals to listen for XEØNAZ, so Lenore had the delight of working a score of YLRL-ers from a highway in Mexico. Lenore adds she is extremely indebted to the Mexicans for permission to operate mobile in their beautiful country and hopes it will be possible for many other Hams in the future.

The "all-YL" Field Day operation of the Los Angeles YLRC. At the topleft is W6MWO, the club station in the prefab shack. W6DXI, Gladys, operates the Gonset "green eyed monster" on 2 meters in the top right photo. W6JZA and W6QGX work the Elmac and Johnson equipment in the bottom photos.

YLs enjoying the Southeastern Division Convention at Atlanta, Ga. Left to right: WN4AGX, Sallie and W4VTO, Suzanne (mother and daughter); W4YEK, Nita; W4UMM, Sarah; W4VKL, Jackie; W4WGZ, Sara, W4WFN, Dot and W4ZDL, Louise.

Conventions

The Southeastern Division Convention held at Atlanta, Ga., on June 6, brought together the eight YLs pictured here. There were no special events for the licensed YLs, though **W4VTO**, Suzanne, did receive a prize for being the youngest YL operator. 16-year old Suzanne, of Balsam, N.C., also recently made headlines as being the youngest YL operator in MARS, having been accepted shortly after the Army lifted its minimum age requirement of 21 years for operators.

The Pacific Division Convention held at San Jose, Calif., on July 3-5 brought together these YLs: W6s BDE, Esther; FEA, Gertie; GQZ, Iva; KNJ, Bettie; LEF, Gin; LFR, Marge; PCN, Peggy; PCR, Louise; PHT, Cynthia; PIR, Mary Ellen; QMO, Jeri; ZTJ, Kay; K6s AEY, Vera; BLM, Ann; CPZ, Marian; KN6s CUT, Myrtle; EZO, Roxanne. The girls had a short YLRL meeting Saturday p.m. and a YLRL breakfast on Sunday morning. Especially lucky in the prize drawing were ZTJ, Kay, and FEA, Gertie, who both took home Ham gear. K6BLM, Ann, won the YL's CW prize.

YLRL Appointments

Soon after W6CEE was elected YLRL's president, she received the resignations of W3OQF, Barbie, former P/C, and W9SJR, Bernice, editor of **Harmonics**, as neither YL felt she could carry on for a second year. To fill these posts for 1954-55 Vada has appointed **W9YBC**, Gloria Matuska, of North Riverside, Ill., to be publicity chairman, and **W3RXV**, Peg Ferber, of Slatington, Pa., as editor.

Although **W9YBC** has held her license only since March '53, she hasn't wasted any time. Gloria has only three states to go for WAS, has 26 confirmations toward WAS/YL, and 65 YL contacts confirmed. A member of RCC, she had well over a thousand QSOs when her OM, W9ATW, decided to treat her to a new receiver, a 75A2. So they sold their SX-71, only to find 75A2s were very scarce, and as this is written W9YBC is temporarily off the air. But she will find plenty to keep her busy for in addition to being YLRL's P/C, Gloria is the newly elected president of the Chicago LARKs. Of course, her jr. ops take a fair share of attention as well—Bunny Jane aged 7, and Skipper 3. The rest of the set-up at W9YBC/ATW includes a Viking II, Viking VFO and VHF-152. They operate mostly on 20 and 40 meters.

W9YBC, Gloria Matuska, publicity chairwoman for the YLRL and newly elected president of the Chicago LARKs.

W3RXV, Peg, came by the post of YLRL's editor quite naturally for she had already been heckling the printer, and addressing and mailing copies of **Harmonics**. Now she will do all the editing as well.

Peg started out with a Novice license and took the exam the first day they were given in July 1951, in New York City. She was the first YL in the East to pass it, and she and her OM, W3RXW, were the first married couple to pass the Novice test together. Peg got her "General" five months later. She and her OM share a Viking I, Viking VFO, SX-43 receiver, and they use an all-band antenna. To date Peg has earned YLCC (No. 21), RCC, a merit certificate for participating in Tobacco Leaf III, a 2nd Army radio maneuver last year, in MARS, and she is working on WAS, WAS/YL, etc. W3RXV is mainly on 75 phone, and she checks regularly into the YLRL nets. She also works 20, 40, 10, 15, 160 and 80 CW.

Peg has a number of other hobbies: pets, raising African Violets (she has some 300 plants, about 90 varieties), and writing news for two local newspapers. She also has a jr. op, Sandra Lee, aged 13. With all this Peg has found time to help her OM build their own home, high on a hill where they have an FB radio location. With such a capable gal, we shall have great expectations for **Harmonics**, Peg!

More YLRL

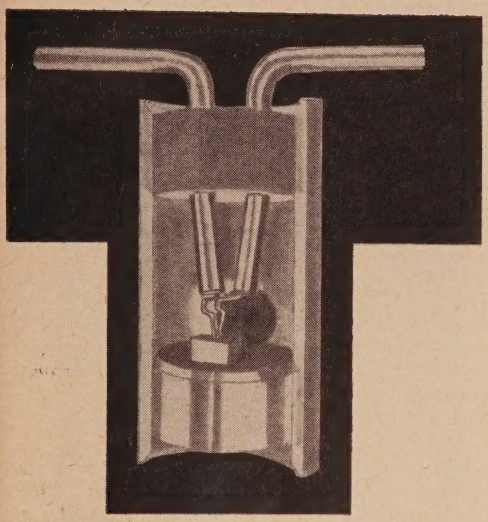
Two more appointments in YLRL. W6CEE announces that **W3TYC**, Miriam Reinhardt of Emporium, Pa., has accepted the post of D/C for the third district. **W4DEE**, Beulah Barrick, has accepted the position of assistant secretary. This is a newly created spot and Beulah's particular job will be to handle subscriptions to **CQ** and **QST**.

Which brings us up to some of Vada's plans for YLRL this coming year. With the treasury at a low ebb, Vada has a progressive program to rebuild it. If you want to help YLRL, send renewal, or new subscriptions for your Ham magazines via W4DEE, Beulah Barrick, 903 Moly Dr., Falls Church, Va. YLRL will receive a small commission for all subs handled.

In another plan to raise money, YLRL is selling personalized return address labels to put on envelopes, etc. About an inch long, they are printed with your name and QTH on gummed paper. Price is 600 labels for $2. Order some via YLRL secretary-treasurer W3UUG, Miriam Blackburn, Box 2, Ingomar, Pa.

Vada also has scheduled a membership-drive contest, with prizes for high individual, high club, 100% YLRL

(Continued on page 60)



First Experiments with TRANSISTORS

HAROLD REED, W3EJP

In the field of semi-conductors, we deal with materials such as silicon and germanium, and when these solids are employed in electronic circuits, it is generally stated that we are working with the electron flow within, or through, a solid. This enables differentiation between the semi-conductor mode of electron flow and that within the radio tube, which obviously takes place in a vacuum.

Some Early History

These certain solids (here we may include the galena of early radio days, the more recent germanium crystal diode, and lately the transistor), are appropriately called semi-conductors since the value of their resistivity first lies between that of a good conductor and then that of a good insulator. They offer high resistance to current flowing in one direction and little resistance to current flow in the reverse direction.

Early semi-conductor solids which were used for detecting, or rectifying the radio signals radiated by broadcasting stations, consisted of small pieces of minerals, such as galena, silicon or carborundum, and were widely used with the well-known catswhisker. Popularly known as crystal detectors, these semi-conductor devices performed as rectifiers of alternating currents due to their almost unilateral conductance characteristics; i.e., they displayed much less resistance to current flow between the catswhisker and crystal in one direction than in the other. Although a small current flows in the reverse direction during rectification, it is so minute as to be negligible in practical operation. These detectors required that the fine wire catswhisker be positioned on a sensitive spot on the crystal for proper rectifier action. They were not very sensitive and required frequent adjustment, the slightest vibration causing disruption of current flow.

During the development of the ultra-high frequency circuits, the crystal rectifier was found more suitable in these applications than the diode vacuum tube, because of its low capacitance, high self-resonant frequency, and negligible electron transit time. Improvements

W3EJP obtained a Class A license in 1934 and for many years worked in the broadcasting industry. Harold has worked all bands with both phone and CW, but now prefers straight experimenting with emphasis on the VHF. Mobile with 50 watts on 10 meters. Now engaged in research and design for the U.S. Recording and Research Corporation. Author of numerous radio and electronics articles. Address: 3917 Madison St., Hyattsville, Md.

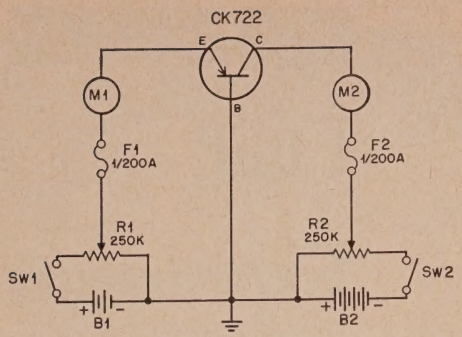
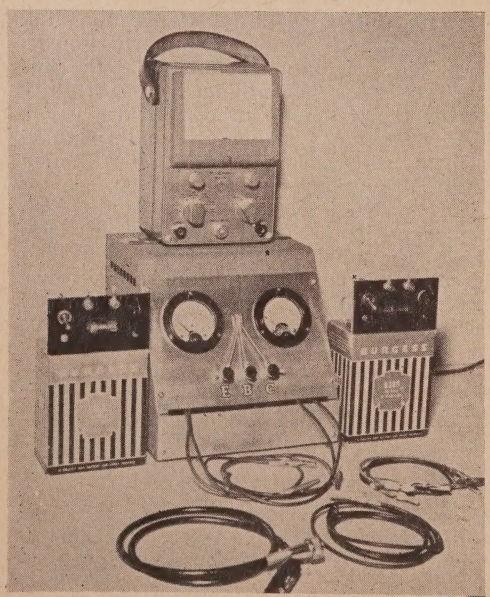


Fig. 1. Experimental test circuit with a PNP transistor connected in a grounded base arrangement. The test bench is shown in the photo at the bottom of this page.

on the old crystal detector resulted in the crystal rectifier, or crystal diode as we know them today, one of the more familiar being the popular 1N34. Germanium or silicon is employed in their construction and the fine wire cats-whisker needs no adjustment, the wire being firmly positioned on the rectifying crystal during manufacture and securely held in place. They are sensitive and stable. Silicon diodes will operate at frequencies from 1000 to 25,000 Mc. Germanium diodes are usually employed at frequencies up to 100 Mc.

However, until the advent of the transistor, electron conduction in semi-conducting materials was restricted to the function of alternating current rectification through two terminal solids. The transistor, basically a three-terminal device, now makes it possible to obtain amplification and oscillation in a semi-conducting solid.



The author's test setup for transistor experiments. Low current fuses protect the transistor.

It is not within the scope of this article to provide a complete analysis of the construction and mechanics of the transistor. We only want to touch on those characteristics deemed necessary to assist in visualizing transistor action.

The resistance to the flow of current through a semi-conductor such as germanium (and all transistors at the present time are made of this element), increases as the purity of the solid is increased. The pure state condition of the germanium crystal can be altered by closely controlled introduction of certain impurities to the crystal structure. When the atoms of an impurity, added to the germanium crystal, possess a greater number of electrons than do the atoms of the germanium itself, a surplus of electrons for transistor action results. This is known as *N*-type germanium. If on the other hand, an impurity is added to the germanium crystal which is composed of atoms with less electrons than the pure germanium, a condition of electron deficiency results in the crystal structure. This then, produces what is termed *P*-type germanium.

"Holes"

We may now summarize the foregoing by stating that in strictly pure germanium, few electrons, or negative charges, are unbound or free to move in the solid, resulting in a poor conductor of current. In the *N*-type germanium there is an excess of electrons (due to the presence of the impurity atoms) which are free to move. These negative charges result in increased current flow. In the *P*-type germanium, impurity atoms are deficient in electrons, which create positive charges, also providing for increased current conduction, and it is the lack of electrons in each impurity atom that is referred to as "hole." These holes, or positive charges, flow in an opposite direction from the electrons or negative charges.

It may seem difficult when beginning a study of transistor action for the student to visualize an electric current existing due to a flow of "holes" through a solid. The author found it simpler to think of this concept of hole conduction as nothing more than the familiar electron movement in the semi-conductor in one direction, while producing a movement of dissimilar charges in the opposite direction. The holes, exhibiting positive charges, attract electrons from other atoms under the influence of their field, thereby moving the holes from atom to atom through the crystal.

Although the point contact and junction transistors are constructionally different, basic transistor action is similar in each. The price of a junction transistor is now within the reach of most students and experimenters and for that reason it will be used in the following tests and illustrations.

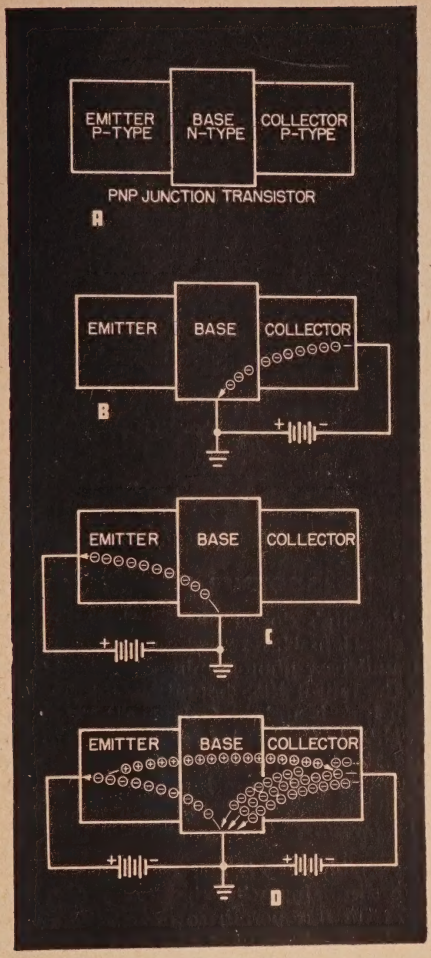


Fig. 2. Simplified diagram of electron flow and "conduction by holes" in the PNP transistor. See the text on this page for detailed explanation of these actions.

The CK722 *Raytheon* PNP junction transistor is made up of three sandwiched layers of germanium (see *Fig. 2a*). The collector and emitter layers, which may be likened to the plate and cathode, respectively, of a vacuum tube, are of *P*-type germanium, while the base, similar in action to a radio tube grid, is *N*-type germanium.

An experimental test circuit is given in *Fig. 1*. Here is shown the CK722 transistor connected in a grounded base circuit. Other circuit connections may similarly be tried. In this particular arrangement, the emitter is at a positive potential due to the manner of connection of battery *B1*, the base is common or ground, and the collector is biased negatively because of the connections made to battery *B2*.

Now if switch *Sw1* is open and *Sw2* is closed, and *R2* adjusted so that the applied voltage between collector and base is -15 volts (-20 volts is the maximum rating for the CK722 but in experimentation it is best not to work too close to the limit), the electron flow between collector and base, as indicated by meter *M2*, will be 500 microamperes. This flow can be likened to crystal diode operation, and in this case, current flows in the high resistance direction through the semi-conductor. This is illustrated in *Fig. 2b*.

If we now open switch *Sw2* and close *Sw1*, and adjust *R1* so that 0.5 volts are applied between emitter and base, an electron flow of 5 milliamperes (the maximum rating), will be observed on meter *M1*. This too, can be thought of as diode operation but in the opposite or low resistance direction. This electron flow is shown in *Fig. 2c*. It is to be noted that 0.5 volts applied between emitter and base caused a current flow of 5 milliamperes, whereas, -15 volts across collector and base resulted in a current of only 500 microamperes.

To continue with our test, we next may close both switches *Sw1* and *Sw2*. If we again adjust *R2* for a collector voltage of -15 volts and set *R1* for an emitter-base current of 5 milliamperes, it will be seen that the collector-base

(*Continued on page 58*)

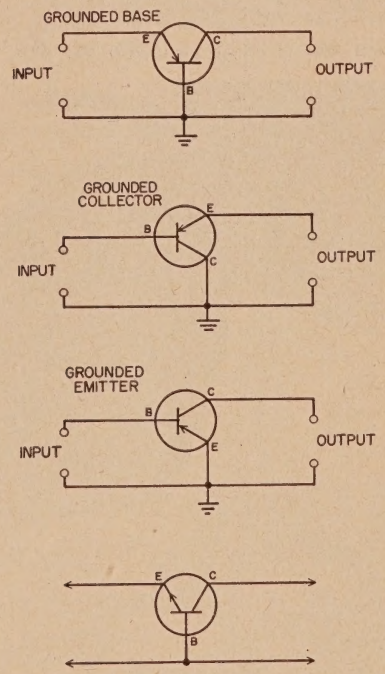
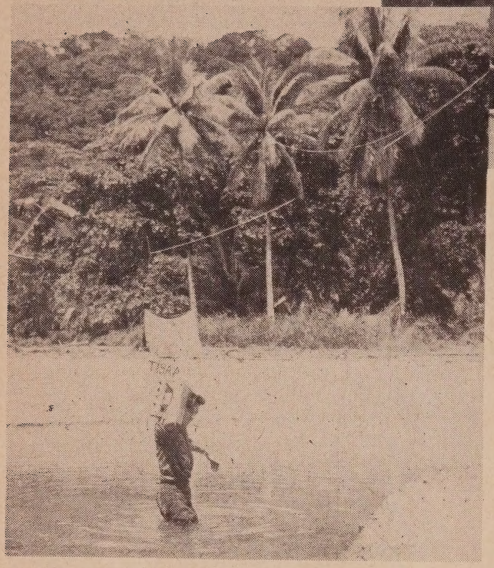


Fig. 3. Basic transistor connections for both the point contact and junction types. The symbol at the bottom of this drawing is sometimes used to denote the junction type, only.

TI9AA

Heino (at the left) with the sailors from the "Xarifa" that helped him ashore with the generator loaned by KZ5AA. Note the dense jungle in the background.



(Above) Wading ashore — (Below) The QTH

by DR. HEINO SOMMER, DI9AA/TI9AA

I am the ship's doctor aboard the "Xarifa" which is the Hans Hass expedition ship specializing in undersea photography. We left Germany in the fall of 1953 bound for the Azores, Caribbean Islands and the Galapagos. While in Bonaire, N.W.I., we decided to route our trip so as to visit the legendary Cocos Islands. It was here that many a treasure hunter has searched in vain for the $300,000,000 in gold supposedly buried by pirates.

Tommy Gabbert, TI2TG, was very instrumental in arranging with the *Radio Club of Costa Rica* for our permit to operate there as TI9AA. At the Panama Canal, KZ5AA supplied us with a small generator and KZ5NM with the *ELMAC* transmitter shown in the photos. Practically everyone we met was anxious to see some Ham activity from the Cocos.

We arrived at the Cocos on January 31 and were duly impressed by this small paradise of dense jungles. Using a 40-meter vertical I made the first contact with the outside world from this island on February 2 at 2324 GMT—appropriately enough it was with TI2TG.

Unfortunately, I did not have all the time to "Ham" that I would have liked. Between times when I wasn't scaring off the wild pigs, I did make 122 contacts which included 49 W's, 46 TI's, 7 CO's, 6 KZ5's, 3 KV4's and one each from HR, HC, TG, etc.

It was a wonderful adventure!

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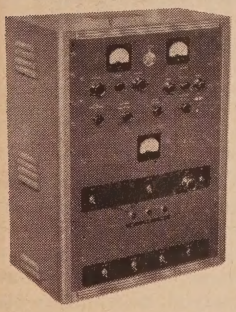
MODEL 500



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HRO-60 Receiver	29.08 (18)	53.35	533.50
Speaker for HRO-60 or NC-183D			16.00

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WRL — BOX 811 — CO BLUFFS, IOWA

This is the model 21A fitted atop the "Junkeyboard." The 21A is a strip printer and is commonly available. The "Junkeyboard" was made from a junked typewriter. The keyboard is used to complete the RTTY installation.

Part One of a Two Part Story

the "Junkeyboard"

JOHN E. WILLIAMS, W2BFD

W2BFD has been active as an "experimenter-Ham" since the 1920's. John worked with the Postal Telegraph Co. and has done quite a bit of shipboard operating. Leaving the latter service in 1929, a business was started which specialized in the manufacture of electronic counting equipment. All of this led to a stint with Republic Aviation during World War II and his present work with RTTY. W2BFD has been the author of numerous articles in both English and Spanish journals. Unquestionably, he was the founding father of RTTY for the Ham. Since 1946 W2BFD has secured RTTY equipment for over 2000 Hams. Handled emergency traffic from the South Amboy, N.J. explosion when quite by accident the RTTY equipment was on demonstration at the Stevens Institute. Operates 144-Mc. mobile and 2meter phone/RTTY. Home Address: 38-06 61st Street, Woodside 77, N.Y.

According to the old formula RTTY is simply a matter of; (1) a regular Ham transmitter*, (2) a teletype printer** and (3) a converter.[1,2] The printer is however a question of (1) a keyboard, (2) the distributors and (3) a typing unit. Typing units can be obtained, distributors can be made, but up till now and the advent of the "Junkeyboard" the typing unit has presented a difficult problem.

For those unfamiliar with RTTY we need to point out that the major source of teletype machines has been those released by the various commercial services. Most "news service"

*Always available from any radio parts jobber—just see the CQ advertisements.

**Available from the author and various other Hams interested in furthering the cause of RTTY.

1. "Double-Current Keying System," Williams, CQ, November, 1946, page 18.
2. "Teletype Receiving Adaptor," Brown, CQ, September, 1952, page 25.

printers are only for receiving and there has been a preponderance of them on the market over the type with keyboards. This resulted in a number of amateurs spending a lot of time sitting around and waiting for keyboards to become generally available.

The "Junkeyboard" is an easy solution—for a small investment of only a $3 to $5 you can pick up a junk typewriter and convert it into a teletype keyboard. The mechanical change-over is relatively simple and as I propose to show in the future issues of *CQ* that it is also valuable to the straight CW operator.

Basic Teletype System

Amateur teletype requires stable transmitters and receivers for best operation. Many of the commercially available equipments meet these needs. Home built equipment can also be stabilized, as we are finding when at last faced with the importance of it.

The converter, a device for changing the audio tone output of the receiver into d-c pulses, is not difficult to build and several diagrams of popular circuits have been adequately described.[1,2] One of the most popular circuits is an improvement on the W2BFD circuit.

Conversion of the keyboard will probably make a little more sense if a brief description of the operation of a printer is nutshelled for you. Consider the three parts of the printer: the typing unit, the distributor and the keyboard. Since the most available machine is the Model 12, it is, therefore, a good one to use for the explanation.

Typing Unit

Electrically this unit consists of six magnets. Five of the magnets are used to select the character to be printed and the sixth causes the selected letter to print. With one side of each magnet grounded, this still makes it necessary to use six wires to operate the magnets.

Distributor

A teletype machine must work from a single pair of wires. The purpose of the distributor is to switch from one to the other of the magnets in the typing unit until all six of them have been connected in turn to the one pair of wires. Essentially then, the distributor is a single-pole six-position switch. Add a seventh position for resting so that no d.c. will be fed to the typing unit magnets until a character comes along the line. There are seven pulses of d.c., the first to start the distributor rotating, the next five to select the character to be printed and the last to print the character.

This distributor is called a receiving distributor. Another distributor at the transmitter is used to line up the pulses in the right time order.

Keyboard

The keyboard must translate the pressing of any key into the five coded pulses which are put into time sequence by the transmitting distributor so that they can be sent over the air and to the receiving distributor. This means that with each touch of a key there must be from one to five contacts connected. If this were to be done mechanically it would give rise to all sorts of problems of adjustment and contact maintenance, not to mention the difficulty of squeezing so many contacts in the small space available under a typewriter. More on this development in the "matrix" section of this article.

Availability

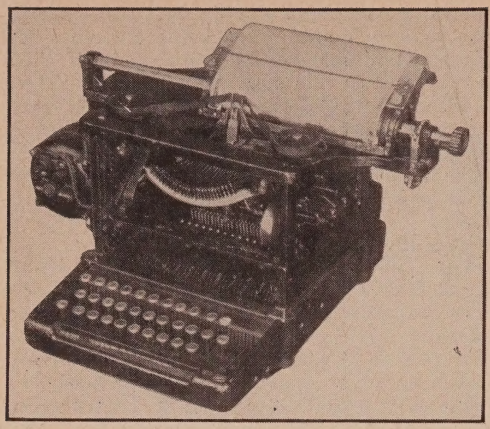
There are plenty of typing units available of the Model 12 and Model 21A types. These units generally cost from $30 to $50. The distributors may be either motor driven affairs which sell in the neighborhood of $40, or may be all electronic in nature and thus home-made. The total cost of the equipment under such conditions should be under $100 for the complete teletype machine and convertor.

Teletype Code

The standard teleprinter five-unit "start-stop" code consists of 5 adjoining 22 milli-

Fig. 1. When stripped down, the only portion of the junk typewriter we need is shown above.

second (0.022 sec.) impulses which may be either "marking" or "spacing" depending on the particular character being sent. In the "make-break" printing method of transmission (CW) these correspond with "key-down" and "key-up" conditions. The almost universal adoption of FSK (frequency-shift-keying) by both commercials and amateurs for teleprinting communications has resulted in the "marking" signal being transmitted on one radio frequency and the "space" signal transmitted 850 cycles lower. In order to maintain the transmitting and receiving distributors in unison two additional impulses have been added to form the "basic" start-stop code. Preceding the five selecting code units is a 22 millisecond impulse which is always "spacing." This is known as the "start"



Model 12 on the junked keyboard.

pulse. Following the 5 selecting units is a longer (31 millisecond) impulse which is always "marking." This is known as the "stop" pulse. The transmission of the complete code for any letter or function thus occupies a total of 163 milliseconds which permits sending 368 characters (or approximately 60 words) per minute (at standard speed).

The Electronic Keyboard

The nucleus of the keyboard in this article is an old typewriter. The machine can be completely unusable for its original function as we merely need the base intact with at least 3 of the 4 rows and the key lever and retracting springs. Typewriters in this condition can be purchased for from $1.00 to $3.00 depending upon whether it is secured from a typewriter shop or a scrap metal yard. A tour of both types of establishments disclosed that these defunct "mills" are to be had in all varieties. If you have any sort of choice in the matter, the old *Remington Model 10* office typewriter is to be preferred. The *Model 12 Remington* also appears to be quite similar in the bottom portion, which is of major interest to us.

The *Model 10 Remington* machine has two improved advantages; (1) the superstructure, when removed, leaves a perfectly smooth platform 11½" wide x 11" deep since the corner posts are part of the top casting and are not part of the base. The midget model 21A printers, recently made available to amateurs, measures 10½" x 11" and as you can see in the photograph they make a professional looking combination; (2) The *Model 10* has a "Universal-Bar" available which rotates upon the depression of any of the keys. A pair of contacts can be installed which are closed by this bar and thus we have our "universal" pulse with a minimum construction effort. As you can see in *Fig. 1*, this bar runs completely across the top of all the key levers. On each key lever will be seen a square headed screw which upon depression of the keys, strikes a bar (see *Fig. 2*) located beneath the key levers and connected by linkage to the "universal" rod. Striking of a screw upon this lower bar rotates the "universal" rod closing the "universal" contacts. These contacts close regardless of which key is pressed. The spacer keylever bar screws are missing and should be added so that the "universal" pulse will also be produced by depression of the space-bar.

Whereas the standard typewriters have four rows of keys, a teletype keyboard sports only three. Thus the next obvious step is to remove the top row of keys from the typewriter. The standard typewriter has only 10 keys in the bottom row, while the teletype keyboard has eleven: remove the right hand key and transfer to the left hand side where you will find a slot in the "comb" already to receive it. This key should be marked "figures" and is used in shifting to upper-case characters. This leaves us short one key on the right hand side. This key, in teletypewriter services, is usually blank and is used for various minor functions. Most amateur machines use this for ringing the bell on

(Continued on page 66)

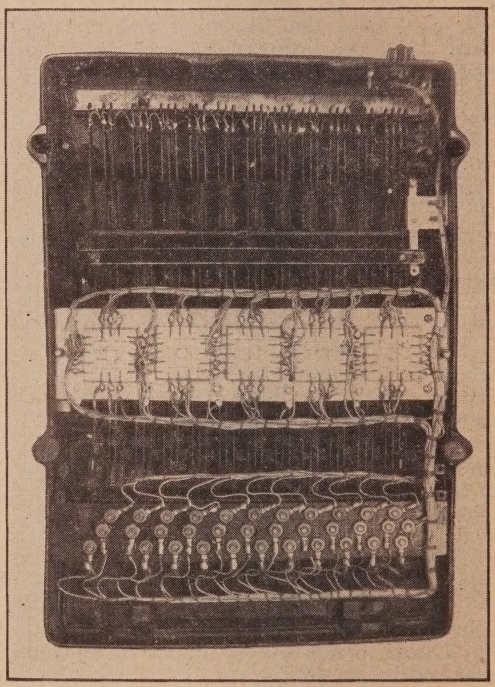


Fig. 2. Underside view of the keyboard from the junked typewriter. The contact bolts are seen in the strip along the top. The odd looking section in the middle will be discussed in the second part of this story.

The VHF-UHF News

220 Mc. Pre-Amp.

The material below was passed to the VHF-UHF NEWS column by Ken Meyers, W8WRN (Columbus, Ohio). This pre-amp was constructed by W8WRN to improve the noise figure he had been obtaining using a simple 6BQ7A mixer on this band. The circuit is straightforward, but in order to duplicate the unit two templates are shown. One is for the copper shield plate and the other is for the BUD Minibox.

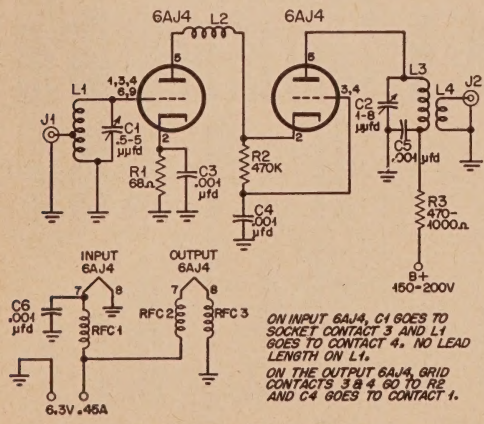
Ken used a JONES P-304-AB cable connector fastened to the leg of the "U" section nearest the output 6AJ4. It is centered vertically about one inch from the side opposite the co-ax output connector. Coil, *L1*, is grounded by the lug under the antenna co-ax connector bolt next to the tube socket.

All parts except the JONES socket are mounted on the copper plate and wired before installing them in the MINIBOX. The leads to the JONES socket are made long enough so that the bolts that hold it can be removed and the assembly slipped out of the MINIBOX. The "U" section should have lips. The copper shield is placed through the center of the output stage socket and is held in place with two spade bolts spaced 2⅞" apart.

Coil, *L1*, has two turns of #16 tinned wire wound with a diameter of about ¼-inch. The spacing between turns should be better than one wire diameter. The neutralizing coil, *L2*, should be 3 turns of #16 (air wound). The spacing will be the variable factor for neutralizing the triodes. Coils, *L3* and *L4*, have the same diameter (¼-inch) with *L4* coupled to the cold end of *L3*. The plate coil is 2 turns of #16 with ⅜-inch leads. The turns are close spaced. *L4* can be 2 turns of #18 hookup wire.

The filament choke, *RFC1*, of the input 6AJ4 consists of 18 turns of #22 enam, with a 3/16-inch diameter. The output chokes, *RFC2* and *RFC3*, are made by twisting two lengths of #22, enam. together and then winding them into 15 turns with a diameter of ¼-inch. Both chokes are coated with a hi-grade plastic dope after winding to enable them to retain their shape.

It is a very good idea to play around with the position of the *L1* coil tap. A noise generator would be a useful item. The input is for a relatively low impedance, but Ken has used this pre-amp with a balun and 300-ohm line with good results.

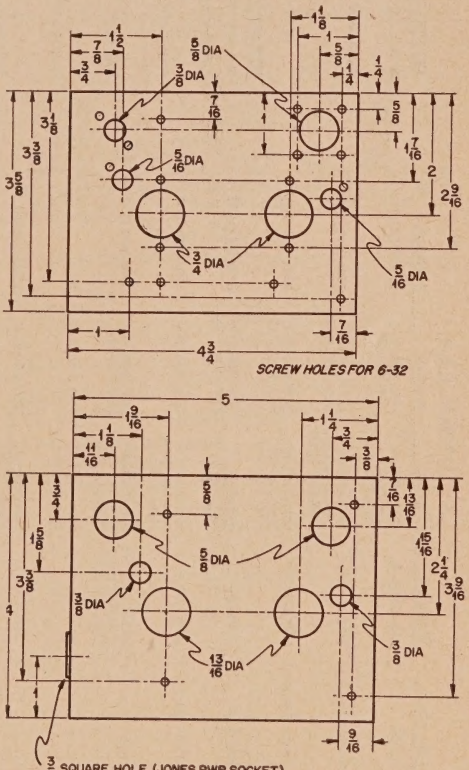


Wiring schematic of the 220 Mc. pre-amp.

Mt. Davis Expedition

A group of York, Pa. using the call W3OCI plan on operating portable from atop Mt. Davis, Pa. on

(Continued on page 50)



At the top is the copper plate chassis that slips inside the BUD Minibox drilled out as shown in the bottom drawing.

ALL TIMES IN E S T

EASTERN USA TO:	15 Meters	20 Meters	40 Meters	80 Meters
Western Europe	1130-1530 (1-2)	0700-1400 (3) 1400-1530 (4) 1530-1730 (1-2)	1700-2130 (3-4) 2130-0400 (2)	1800-0130 (3)
Central Europe & Balkans	1100-1500 (1)	0700-1300 (2-3) 1300-1530 (3-4) 1530-1800 (1-2)	1700-2200 (3) 2200-0300 (2)	1800-0100 (2)
Southern Europe & North Africa	1100-1530 (1-2)	0630-1300 (3) 1300-1600 (4) 1600-1830 (1-2)	1700-2100 (3-4) 2100-0200 (2-3)	1800-0100 (2-3)
Near & Middle East	1100-1300 (1)	0630-1230 (1) 1230-1400 (2-3) 1400-1530 (1-2)	1800-2100 (2-3) 2100-2300 (1-2)	2000-2300 (1-2)
Central & South Africa	1200-1530 (1-2)	0630-1300 (1) 1300-1530 (1-2) 1530-1830 (2-3)	1800-0000 (2-3)	1930-2300 (1-2)
South America	1200-1700 (1-2)* 0900-1600 (1-2) 1600-1830 (2-3)	0630-1600 (2-3) 1600-1900 (3-4) 1900-0000 (1-2)	1800-0500 (3) 0500-0700 (2)	1900-0430 (2)
South East Asia	Nil	0700-1000 (1) 1630-1830 (0-1)	0300-0700 (0-1)	Nil
Australasia	1700-1930 (0-1)	0700-1000 (2) 1600-2000 (1) 2000-2130 (1-2)	0000-0800 (2-3)	0100-0700 (2)
Guam & Pacific	Nil	0730-1000 (1) 1500-1930 (0-1) 1930-2100 (1-2)	2230-0730 (3)	2330-0700 (2)
Japan & Far East	Nil	0700-0900 (1-2) 1600-2000 (1)	0200-0700 (1)	0300-0600 (0-1)

ALL TIMES IN C S T

CENTRAL USA TO:	15 Meters	20 Meters	40 Meters	80 Meters
Western & Central Europe	1200-1530 (0-1)	0700-1400 (2-3) 1400-1530 (3-4) 1530-1700 (1-2)	1700-2000 (3) 2000-0300 (1-2)	1830-0100 (2-3)
Southern Europe & North Africa	1300-1600 (1)	0630-1400 (3) 1400-1600 (4) 1600-1730 (1-2)	1700-0130 (3)	1830-0030 (2-3)
Central & South Africa	1000-1530 (1-2)	0600-1300 (1) 1300-1530 (2) 1530-1800 (2-3)	1730-0000 (2-3)	1830-2300 (1-2)
Central America & Northern South America	1200-1600 (1-2)* 1000-1600 (3-4) 1600-1730 (1-2)	0600-1500 (3-4) 1500-1930 (4-5) 1930-2200 (2)	1700-0500 (4-5) 0500-0730 (2-3)	1800-0500 (2-3)
South America	1200-1600 (1-2)* 0900-1500 (2-3) 1500-1730 (3)	0600-1600 (2-3) 1600-1900 (3-4) 1900-0000 (2)	1800-0600 (3-4)	1900-0430 (2-3)
Japan & Far East	Nil	0700-0930 (1-2) 1400-1700 (1) 1700-1930 (2)	0100-0800 (1-2)	0200-0700 (1)
South East Asia	1500-1700 (0-1)	0730-1000 (1) 1500-2000 (1)	0230-0800 (1)	0330-0600 (0-1)

ALL TIMES IN C S T

CENTRAL USA TO:	15 Meters	20 Meters	40 Meters	80 Meters
Hawaii	1400-1900 (1-2)	1000-1900 (2-3) 1900-2100 (3-4)	2130-0200 (4) 0200-0800 (2-3)	2300-0700 (3)
Australasia	1600-2000 (1)	0630-1000 (1-2) 1300-1900 (1) 1900-2130 (2)	0000-0800 (3)	0100-0700 (2-3)

ALL TIMES IN P S T

WESTERN USA TO:	15 Meters	20 Meters	40 Meters	80 Meters
Europe & North Africa	Nil	0800-1430 (1-2)	1800-0030 (1)	1900-2330 (0-1)
Central & South Africa	1300-1500 (1)	0700-1330 (0-1) 1330-1800 (2)	1700-2200 (2-3) 2200-0000 (1)	1800-2200 (1-2)
South America	1200-1600 (1-2)* 1000-1730 (3-4)	0600-1500 (2) 1500-1830 (3-4) 1830-0000 (1-2)	1730-0400 (3-4)	1830-0400 (2-3)
Okinawa	1400-2100 (1)	0800-0930 (1) 1200-1900 (2) 1900-2200 (3-4)	0100-0600 (3)	0200-0500 (2)
Guam & Mariana Islands	1400-1930 (2)	0730-0900 (1) 1200-1900 (2) 1900-2200 (3)	0030-0700 (3-4)	0130-0630 (2-3)
Australasia	1400-1900 (1)* 1100-1800 (1-2) 1800-2000 (2-3)	0930-1100 (1-2) 1100-1800 (1) 1800-2200 (2-3)	2200-0700 (3)	2300-0600 (2-3)
Japan & Far East	1500-2200 (1-2)	1130-1800 (2-3) 1800-2200 (3-4)	2300-0700 (3-4)	0000-0600 (2-3)
Philippine Islands & East Indies	1500-2100 (0-1)	0800-1100 (2) 1300-1900 (0-1) 1900-2230 (1)	0200-0600 (1)	0300-0500 (0-1)
Malaya & South East Asia	1600-2000 (0-1)	0730-1000 (1) 1600-2000 (0-1) 2000-2230 (1)	0400-0700 (1)	0500-0630 (0-1)
Hong Kong, Macao & Formosa	1500-2100 (1)	0800-0930 (1) 1400-1900 (1-2) 1900-2230 (2-3)	0100-0600 (2-3)	0200-0500 (1-2)

Symbols For Expected Percentage of Days of Month Path Open:

(0) None (1) 10% (2) 25% (3) 50% (4) 70% (5) 85% or more

*Indicates time of possible ten-meter openings.

These tables are based upon a radiated CW power of 150 watts and are centered on Washington, St. Louis and Sacramento. These forecasts are, for the most part, made using basic ionospheric data published by the CRPL of the National Bureau of Standards, and are valid until October 15.

Ionospheric Propagation Conditions

Predicted by
George Jacobs, W2PAJ
144-40 72nd Ave., Flushing, L. I., N. Y.

6 METERS: The fairly frequent sporadic E openings observed during the summer months will decrease considerably during September and the fall and winter months

10 METERS: Some DX possible during daylight hours on long north-south circuits. Short skip openings decreasing.

15 METERS: DX possibilities fair and improving, especially during the latter part of September and early October.

20 METERS: Band closing somewhat earlier, but DX conditions fair to good. This will be the best DX band during the daylight hours.

40 METERS: DX fair and improving. Band will open earlier in the evening with stronger signals and less atmospheric noise. Best DX band during the evening and dark hours.

80 METERS: DX fair to poor with conditions improving as fall and winter approaches.

160 METERS: Still too early for consistent DX, but band conditions are improving and becoming less noisy. Possible openings to Australasia and Europe towards the end of the month on propagationally quiet nights

This overall picture of band conditions is intended to indicate qualitative changes in each band from month to month. For specific times of band openings for a particular circuit refer as usual to the **CQ Propagation Charts** on the opposite page.

Contest Analysis

In order to supply predictions to overseas readers of **CQ**, participating in the **World-Wide DX Contest** (sponsored by the International DX Club), we have made arrangements to distribute propagation information with the contest rules and entry sheets. These are obtainable from the Club at Box 100, Buchanan, Mich., U.S.A. This information includes special tables centered on many areas of the world and are valid for the period from October 1 through November 15. They may be used by amateurs in Europe, Asia, Australasia, Central and South America.

The Sunspot Cycle

The September and October **Propagation Charts** are based upon a predicted smoothed sunspot number of 5. The observed monthly Zurich sunspot number for June, 1954, was 0.2; resulting in a smoothed sunspot number of 7.6, centered on December, 1953. The smoothed sunspot numbers continue to **decrease** although it now appears that shortwave radio conditions this summer were actually about the same, or possibly a little better than conditions were last summer.

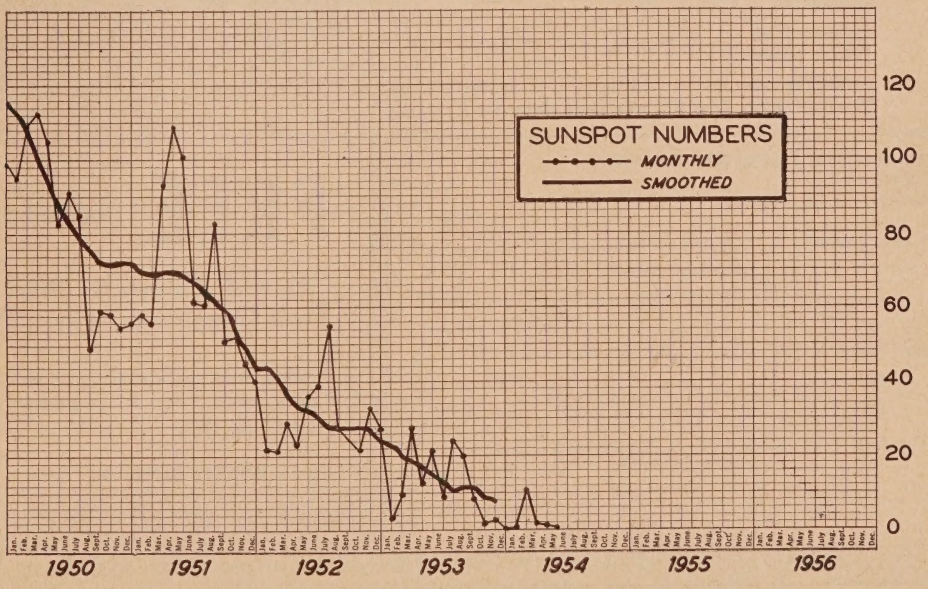
Last Minute Predictions

Ionospheric disturbances tend to increase during this period of the year. At this writing, disturbed conditions are expected from September 3-4, 8-9 and 21-22.

A graph showing the present trend of the cycle is reproduced below. Our present plans call for the graph to be corrected and used every other month. This we hope will give the reader a better idea of exactly what the future looks like.

Next Month

A special contest analysis for the all areas of the U.S.A.



Another First for INTERNATIONAL CRYSTAL

International Crystal, first to offer nationally advertised One-Day processing of small lots of commercial crystals, now offers the same service to amateurs for spot frequency crystals.

SPOT FREQUENCY

.01% TOLERANCE—Crystals are all of the plated, hermetically sealed type and calibrated to .01% or better of the specified frequency when operated into a 32 mmf load capacitance.

ONE-DAY Processing

Orders for less than five crystals will be processed and shipped in one day. Orders received on Monday thru Thursday will be shipped the day following receipt of the order. Orders received on Friday will be shipped the following Monday.

International
TYPE FA-9

(fits same socket as FT-243)

RANGE (kc)	TOLERANCE	PRICE
3500-4000	.01%	$2.80
7000-7425 8000-8222	.01%	$2.80
12500-13615 14000-14850	.01%	$3.90
24000-24333 25000-25500	.01% *(For 3rd overtone operation)*	$3.90

HOW TO ORDER

In order to give the fastest possible service, crystals are sold direct and are not handled by any jobber. Where cash accompanies the order, International will prepay the Air Mail postage; otherwise, shipment will be made C.O.D. Specify your exact frequency and the crystal will be calibrated to .01% or better of this frequency with the unit operating into a 32 mmf load capacitance.

International Crystal Mfg. Co., Inc.
18 North Lee
Oklahoma City, Okla.

Price

Please Send: _____Crystals Freq._____ _____
_____Crystals Freq._____ _____
_____Crystals Freq._____ _____

TOTAL $_____

TO: Name:_____

Address:_____

City_____Zone:_____State:_____

Enclosed: ☐ Check, ☐ Cash, ☐ M.O. for $_____, or Ship C.O.D. ☐

FREE BOOKLET

"Plated Crystals and Their Operation."

Useful information about the "do's" and "don'ts' in using plated crystals

WRITE DEPT. X

International CRYSTAL Mfg. Co., Inc. 18 N. Lee Phone FO 5-1165 OKLAHOMA CITY, OKLA.

All About Impedance Bridges

Part VIII of the Series

Test Equipment in the Ham Shack

by

HOWARD BURGESS, W5WGF

The hobby of amateur radio is advancing at such a pace that tube types of several seasons back have become obsolete and an engineer risks his reputation if a prewar circuit is used without renaming it first. Under these conditions it is interesting to note that the most accurate and widely used circuit for the measurement of resistance, capacity, and inductance has remained relatively unchanged since it was originated more than one hundred years ago.

We are referring to the "Wheatstone bridge." The bridge which bears the name of its first user was intended for the purpose of measuring d-c, or pure, resistance. However, in the intervening years there have been several modifications of the basic circuit which make it suitable for measuring capacity and inductance. Even though these modified forms may carry other names, they retain the basic configuration of the early resistance bridge.

The bridge commonly known as the *Wheatstone* generally takes the form of four resistance arms such as that shown in *Fig. 1*. This is the standard method for the accurate measurement of pure resistance. For all practical purposes this bridge is simply two voltage dividers paralleled across a d-c voltage source. When the ratio of *R1* to *R2* is the same as *R3* is to *R4*, there will be no potential difference between points *A* and *B*. In this condition the bridge is balanced and can be indicated as

$$\frac{R1}{R3} = \frac{R2}{R4}$$

This can be rewritten to read:

$$R3 = \frac{R1\ R4}{R2} \quad or \quad R3 = \frac{R1}{R2} \times R4$$

If *R1*, *R2* and *R4* are known, *R3* is easily found.

To use this as a measuring instrument an unknown value of resistance can be inserted at *R3* and the other three legs varied until a balanced condition is reached. To eliminate the use of the formula each time a measurement is made, *R1* and *R2* are fixed precision resistors and their ratio becomes a simple multiplier for *R4*. The resistor *R4* usually takes the form of a calibrated variable. To be able to measure a wide range of unknown resistors, various values of *R1* and *R2* are inserted by means of a rotary switch. The points on the switch dial are calibrated only as multipliers for *R4*. For all practical purposes the precision of this type of measurement is limited only by the sensitivity of the indicating meter and the accuracy of the three known legs of the bridge.

The A-C Bridge

In the measurement of pure resistance, the balance depends only on the magnitude of the current, but in the measurement of circuit constants at audio frequencies we become concerned with the phase as well as magnitude.

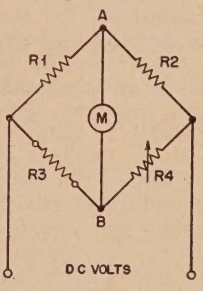


Fig. 1. Basic Wheatstone bridge circuit.

To overcome this difficulty modified bridge circuits are used. The type of a-c bridge circuit used is determined by the measurement to be made.

An important characteristic of a coil or condenser, and the same one which gives us the phase difficulties, is the ratio of resistance to reactance. This ratio can be considered as a measure of the merit of a capacity or inductance. An ideal coil would have inductance without resistance and all of the power stored in it could be recovered. However, as there is

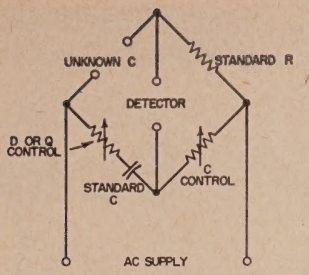


Fig. 2. Adaptation of the Wheatstone bridge to enable the measurement of capacity.

no such coil, part of the power is dissipated in the resistive component and is lost. This loss depends directly upon the ratio of resistance to inductive reactance. This is the storage factor of the coil commonly known as the Q and can be expressed as:

$$\textit{Storage factor or } Q = \frac{\textit{Inductive Reactance}}{\textit{Resistance}}$$

The term Q besides indicating the resistive component also indicates the voltage step-up ability of a coil and for this reason is more commonly used as a measure for inductors.

In the measurement of capacitors we are concerned not with step-up ability as in the coil but in the loss which occurs in the capacitor, this loss usually being in the dielectric. Loss being the opposite of gain, the term dissipation factor is used and is the reciprocal of Q *or*

$$\textit{Dissipation factor} = \frac{1}{Q} = \frac{R}{X}$$

To measure capacity, the earlier resistance bridge must be modified somewhat as shown in *Fig. 2.* Two of the arms may remain resistive but the unknown capacity must be balanced against a known value of capacity which we call the "standard." In building a bridge we will assume that the *standard* condenser is of the best quality that we can afford, and that its dissipation factor will be better than any which we will be measuring. Working under these assumptions, if we are to get a balance or null with condensers of less efficiency we will have to be able to increase the dissipation of the *standard* at will. This is done by adding resistance to the *standard* capacity leg of the bridge of *Fig. 2.* The amount of resistance which must be added to the *standard* will equal the loss resistance of the condenser being measured.

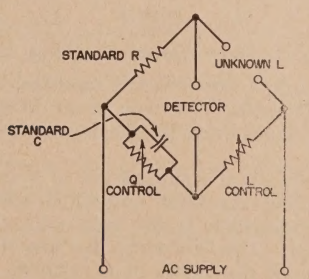


Fig. 3. Further modification of the basic Wheatstone bridge will provide a means of measuring inductances with a low Q.

The variable resistor which is added to the *standard* capacity leg of the bridge to complete the balance function is calibrated as power factor in many small condenser checkers. In the larger bridges, usually called impedance bridges, this control is known as the *"DQ* control" and is calibrated directly in dissipation factor and Q.

Inductance Measurements

The bridge in *Fig. 2* is basically a capacity measuring affair although a slight modification will make it suitable for inductance. If the bridge is arranged as that in *Fig. 3* by inserting the unknown in the leg opposite the *standard* capacity rather than in the adjacent leg, it becomes an inductance measuring bridge. By moving the unknown to this new position, an inductance can be measured using a capacitor as a *standard.* This is due to the phase shifts peculiar to a bridge circuit.

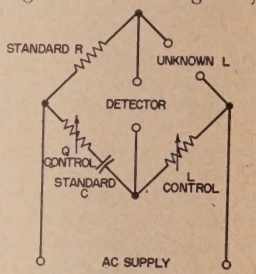


Fig. 4. Nearly the same circuit as Fig. 3, but this bridge can be used to measure high Q inductors.

By making use of this feature we can eliminate the need for a *standard* inductor. Not only is this an economic factor but it increases the accuracy and stability of the bridge. Even a low-priced capacitor is a more stable *standard* than an expensive inductor. In addition the condenser is not afflicted with stray lines of force which can give erratic effects.

When used to measure inductance, another form is also used and is shown in *Fig. 4.* As can be seen the only difference is the placement of the *"DQ"* resistor, that in *Fig. 3* being used if the Q is less than 10 and that in *Fig. 4* when the expected Q is between 10 and 1000.

Perhaps it is needless to say that when these circuits are used to measure inductance and capacity a source of a-c voltage must be supplied to the bridge and the detector which was formerly a d-c meter must become an a-c indicator.

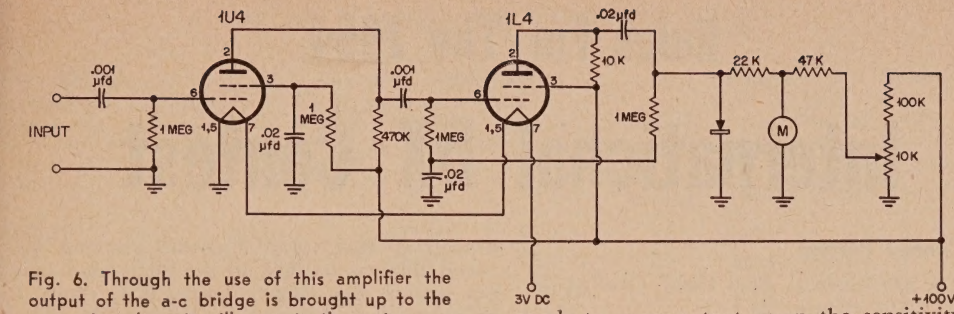


Fig. 6. Through the use of this amplifier the output of the a-c bridge is brought up to the point where it will operate the meter.

Even though these basic circuits were old long before radio was born, they have been given some new twists that only modern parts and techniques could add. This has also had the effect of taking the impedance bridge out of the laboratory and making of it a very useful piece of test equipment available to the average Ham and serviceman at a modest cost.

Impedance Bridges

One example of a modernized version of the bridge circuits just mentioned is the *Model IB-2* impedance bridge now being supplied in kit form by the Heath Co. In it new techniques are used to overcome several of the problems that are inherent in the impedance bridge. In addition to the regular Wheatstone bridge circuit, this instrument also uses several of the modified a-c bridge circuits. However, this does not complicate its operation as the proper circuit is selected automatically by the function switch.

In the older d-c resistance bridges the ever-present batteries were usually dead just when they were needed most. This has been eliminated by using a selenium rectifier power supply operating from the regular 60-cycle power line. Because the accuracy of measurement depends to some extent upon the sensitivity of the indicating meter, a zero center meter with a sensitivity of 100 microamps full scale either side is used. For preliminary balance the meter is shunted with a 2.2-ohm resistor to reduce its sensitivity. For final adjustment this may be removed by means of a spring loaded momentary switch.

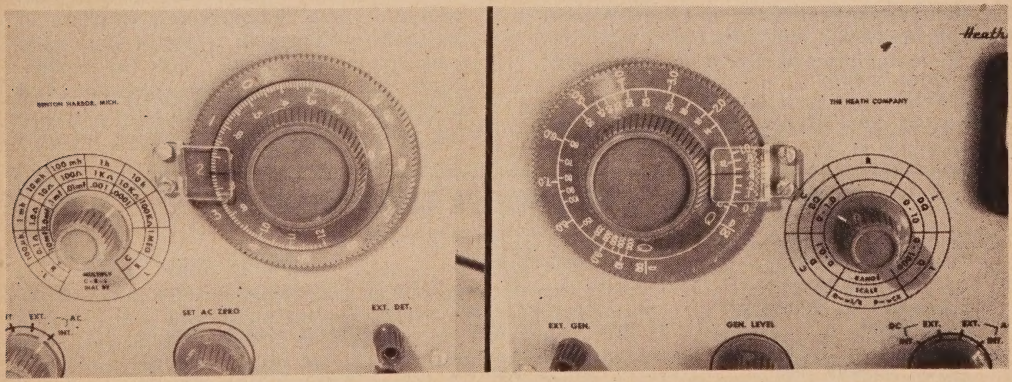
While it is difficult to state the exact accuracy of such an instrument without a step-by-step calibration of a good many points, an average of 3 per cent is called out in the specs. In checking several points in the range, which runs from 0.1 ohm to 10 megohms, it was found to split the line at a number of points. However, this kind of accuracy is too much to hope for at all points as the resistors used in the instrument are 0.5 per cent units and in some cases this can be cumulative.

Any non-linearity in the balancing potentiometer will also add to the error. If judgment can be passed on other instruments from what was found in one, it is safe to say that the accuracy of the instrument is in most cases considerably better than that called for in the specifications.

Design Considerations

In any a-c bridge, two of the problems en-

(Continued on page 52)



The two dials on the left are used on the Heathkit IB-2 to directly read capacity, inductance and resistance values. The special DQ dial is shown in the right photo. It enables the operator to find the amount of loss in the inductance or capacitor being checked. See the text for additional details.

Rules For The 1954

International DX Contest

1. Contest Period:

PHONE SECTIONS: 0200 GMT October 23 to 0200 GMT October 25
CW SECTIONS: 0200 GMT October 30 to 0200 GMT November 1
(See time chart for local times and dates.)

2. Bands:

The contest activity will be in the 1.8, 3.5, 7, 14, 21, and 27/28-Mc amateur bands.

3. Types of Competition:

Competition will be divided into four sections as follows:

a) One-operator phone section
b) Multiple-operator phone section
c) One-operator CW section
d) Multiple-operator CW section
e) Inter-club competition

4. Equipment:

There will be no limit to the number of transmitters and receivers allowed, and competitors may use the maximum transmitter power permitted under the terms of their licenses.

5. Serial Numbers:

CW stations will exchange serial numbers consisting of five numerals, the first three being the RST report, and the last two being their own Zone number. Stations in Zones 1 through 9 will prefix their Zone number with zero (01, 02, 03, etc.). Phone stations will exchange serial numbers consisting of four numerals. The first two being the readability and strength report, and the last two being their own Zone number. Phone stations in Zones 1 through 9 will prefix their Zone number with a zero (01, 02, 03, etc.).

6. Points:

Contacts between amateur stations on different continents shall count 3 points; contacts between amateur stations on the same continent, but not in the same country, shall count 1 point; contacts between stations in the same country, for the purpose of obtaining zone and/or country multipliers, shall be permitted, but no QSO points will be allowed for these contacts. More than one contact between stations on each band will not be permitted.

7. Multipliers:

Two types of multipliers will be used: (1) a multiplier of 1 for each Zone contacted on each band, (2) a multiplier of 1 for each country worked on each band.

8. Awards:

Certificates will be awarded for each of the Sections as follows:

I. To the highest scoring stations on each SINGLE BAND in the following areas:
   a) Each call area of the U.S.A.
   b) Each licensing area of Canada and Australia
   c) All other countries

II. To the stations having the highest combined total on ALL BANDS (or more than one band) in the following areas:
   a) Each call area of the U.S.A.
   b) Each licensing area of Canada and Australia

III. Inter-Club Competition
   A certificate will be awarded to the DX Club having the highest total score in each country. For a club to enter, an officer of the club must submit a list of their club participants with scores. This list may include the score of single operator and multiple operator stations. Each participating club station, when submitting his own

INTERNATIONAL WORLD-WIDE DX CONTEST SCHEDULE

First weekend CW, second weekend phone

Time Zone	Starting Time	Ending Time
Greenwich Mean Time (GMT) (London)	Saturday Oct. 23, 0200 Saturday Oct. 30, 0200	Monday, Oct. 25, 0200 Monday, Nov. 1, 0200
U.S.A. Eastern Standard Time	Friday, Oct. 22, 9:00 PM Friday, Oct. 23, 9:00 PM	Sunday, Oct. 31, 9:00 PM Sunday, Oct. 31, 9:00 PM
U.S.A. Pacific Standard Time	Friday, Oct. 22, 6:00 PM Friday, Oct. 29, 6:00 PM	Sunday, Oct. 24, 6:00 PM Sunday, Oct. 31, 6:00 PM

WORLD-WIDE DX CONTEST LOG

CALL 4X4RE COUNTRY Israel PHONE ☐ C. W. ☒

LOG FOR 14 MC. BAND (Use separate log for each band.) CALL LETTERS OF OTHER OPERATORS NR. OPERATORS one

DATE (GMT)	TIME (GMT)	STATION	SERIAL NUMBERS		FILL IN ONLY WHEN QSO IS A MULTIPLIER		POINTS (1 or 3)
			SENT	RECEIVED	WAZ ZONE NR.	NAME OF COUNTRY	
Oct 30	0700	CE3AG	57920	57912	12	Chile	3
"	0703	HZ1KE	58920	58921	21	Saudi Arabia	1
"	0706	W4KFC	59920	58905	5	USA	3
"	0707	W3GRF	59920	58905			3
"	0708	4X4BX	59920	59920	20	Israel	
"	0710	CR5AC	56920	56935	35	Port. Guinea	3
TOTAL NUMBER ZONES, COUNTRIES, POINTS:					5	5	13

Important Note: Fill in Zone number and Country ONLY FIRST TIME it is contacted on each band.

station log, should indicate on his log the name of his club.

Certificates will also be awarded to each operator of each winning station in the multiple operator sections. Also such special awards as the DX Committee shall choose to make.

9. Scoring:

The contest score for each single band is the sum of the Zone and Country multipliers of each band, multiplied by the contact points of that band. The total all band score is the sum of the Zone and Country multipliers of all bands, multiplied by the total of contact points on all bands.

I Everyone who sends in a log for a single band is eligible for a single band award only.

II Those who submit logs for two or more bands will be eligible for the All-Band award, as well as the Single-Band award. For the purpose of club scores, all classes of individual scores may be included in the grand total.

10. Zones and Continents:

To check your own Zone number and continent for scoring purposes, refer to ARRL list or *CQ* (April 1953) as well as the WAZ maps. For continental boundaries the same as used for WAC will be recognized. Should any question arise as to the positive location of any station, the official definitions will be final. Copies of the country and zone list and contest logs are available from the address listed below, upon receipt of a stamped, self-addressed envelope, or in the case of overseas stations, unattached postage stamps. Please include sufficient postage.

All logs must be postmarked no later than December 15, 1954. Send logs direct to:

International DX Club
P. O. Box 100
Buchanan, Mich., U.S.A.

Operating Suggestions:

Attention. Foreign Amateurs! It is recommended that you give the call letters of the station you are working at the end of a transmission, instead of just "BK," as this would prevent much QRM of stations piling on and calling you.

We suggest that overseas phone operators indicate which end of the band they are tuning, or which portions of the phone band (American or foreign) they intend to tune. On 28 or 21 Mc., it is extremely important that overseas phone stations specify the approximate frequency they intend to tune. CW stations, likewise, could greatly assist by indicating where they intend to tune. If the above principle is used by all, it will result in far less QRM, as well as fewer useless calls.

Foreign amateurs, remember scores are based on the greatest number of different countries and zones as well as stations worked. Do not concentrate on working only U.S. stations, this is a World-Wide competition!

ESSE BARGAIN SPECIALS

NEW SURPLUS 400 CYCLE 115 V. TRANSFORMERS

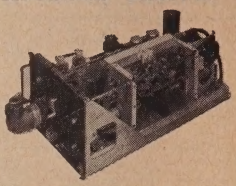
Delco #7249009, 115 V. 400-2600 cycles, 2.6A. Tapped 75, 80, 85, 105, 125 volts. Sec. 680 V.CT. 300 MA. Size 6¾" H x 4" C x 4½" W.

Quantity Price **$1.75** ea. Single Price **$3.75** ea.

GE 229619-44, 115 V. 400 cy. primary. Secondary 13.5 KV @ 13 MA.

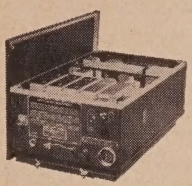
Quantity Price **$ .75** ea. Single Price **$1.95** ea.

T-39/APQ-9 RADAR XMTR



Described in Feb. '50 "CQ" for conversion for the 420-450 Mc. amateur band and citizens band. Also contains many parts for the UHF experimenter such as 2—8012 tubes, fan and motor, switches, pots, gears, counter, etc. Equipment removed from aircraft. Our Close Out, quantity limited. **$4.95** ea.

Shipping wt 43 lbs.



BC-433-G RADIO COMPASS

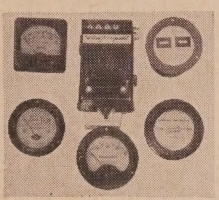
Three band coverage of 200-1750 Kc. Ideal for use as home or mobile receiver for long wave, broadcast listening or may be used with components listed below for automatic direction finding. All 17 tubes included. Removed from surplus aircraft. Wt. 43 lbs. Price **$14.95**

SCR-269 ACCESSORIES

LP-21A or F loop antenna	$15.00 used
CD-365A cord assembly	4.50 new
I-81A Indicator	7.50 new

C-1 AUTO PILOT SERVO

Use for boat rudder control, beam antenna rotation, or garage door lift. (A very good lift using this motor is mfgd. in our city and may be purchased from us at $137.50). Motor pulley rotation is reversed thru a clever differential and electric solenoid mechanism allowing instant reversal without undue stress on motor. Operates on 24 V. DC. Size overall 10½" x 8½" x 6½". Wgt. approx. 20 lbs. Brand New..... ea. **$12.50**

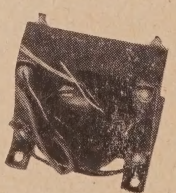


METER BARGAINS

All brand new.

0-30 Amp. Hoyt 3" round DC Ammeter	$1.50
0-40 volt, Hoyt 3" round DC voltmeter	1.50
0-600 Amp. Hoyt 3" round DC ammeter (less shunt)	1.00
0-30 volt DC Weston 606 2" round aircraft	2.95
0-60 amp. DC Weston 606 2" round aircraft (Ext. shunt supplied)	2.95
0-150 volt DC Weston 606 2" round aircraft	2.95
0-240 Amp. DC Weston 606 2" round aircraft (Ext. shunt supplied)	2.95
0-10 Ma. DC Westinghouse NX35, 3" round	3.95
0-10-100 Ma. DC Triplett 321-T, 3" round	3.95
0-800 Ma. DC Westinghouse NX-35, 3" round	3.95
DB F/S 5V. AC Westinghouse NX-35, 3" round	3.95
0-5 Amp. RF Westinghouse NX-35, 3" round	3.95
Cramer Running Time Meter, 3" round, RT2H 115 V.60 cy	9.50
JBI Freq. Meter 48-62CPS Model 30F, 3" round	9.50
EC94 Prod. Instr. Counter 115 V. 60 cy	9.50
EC94 Prod. Instr. Counter 23 V. DC	9.50

12 V. VIBRATOR TRANSFORMER

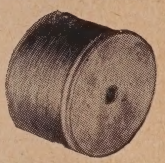


300 V. @ 65 Ma. output. Ideal for your new car receivers. High quality type transformer designed originally for aircraft. Size overall 2⅞"x2½"x2⅝" ..... **95c** ea.

GRIMES RETRACTABLE LANDING LIGHTS

Contains 600 watt 24 V. lamp. Use four in these in series on 110 V. for flood lighting or small motor and retracting mechanism easily adapted for your disappearing appliances in homes, etc. Used..... ea. **$3.95**

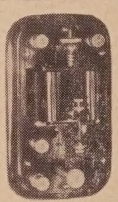
GUY WIRE — 5,000' spool — $1.95 per 1,000'



Extra strong snarl, and rust resistant cable. Originally used for aircraft control cable, has 21 strands alloy brass plated to resist corrosion. 350 lb. breaking test. OD 3/64". Ideal TV Antenna guy wire. Wound on wood & metal spool of 5,000' length. Per spool **$9.75**

3/16" Stainless Steel Aircraft Control Cable ideal for large Xmtg. Beams (over 1,000 lb. breaking strength. New... **3c/ft.**

¼" Galvanized Stranded Utility Pole Guy Wire 500 ft. reels only..... **5c/ft.**



RELAY - TELEPHONE TYPE SW 37

150 ohm DC. Adjustable for spring tension, amateur distance, and point contact, allows sensitivity variations. May be used also for telegraph sounder. Size 8"x4⅜"x 4". Shipping weight 3½ lbs. New Price ..... ea. **$3.95**

1625 TUBE 12 V. 807

These tubes are 807's with a 12 V. filament making them ideal for new 12 V. car mobile transmitters.

BRAND NEW, Guaranteed ..... ea. **59c**

Lots of 10 or more ..... ea. **39c**

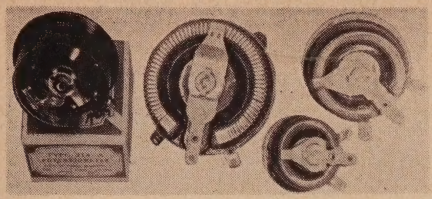
CO-AXIAL CABLE

RG/8U	100 ft.	$4.95
RG/29U Amphenol	100 ft.	$1.95

1000 ft. or more, 20% discount

TRIP RELAY

Instantaneous class 9055 Type N. Manufactured by Square D Co. 23-47 amp. range; 600 V. Max. Shipping weight 3½ lbs. Brand New ..... ea. **$1.35**



GENERAL RADIO TYPE 314-A POTENTIOMETER

20,000 Ohm, 8 watt complete with knob and mounting hardware in original box. 3" dia. by 1⅜" deep with 1"x⅜" dia. shaft. Precision wire wound. Shipping weight 1 lb.

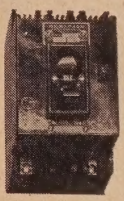
New Price ..... **$1.50** ea.

Ohmite Model L-7.5 Ohm, 150 watt
New Price ..... **$3.95** ea.

Ohmite Model K-7.5 ohm, 100 watt
New Price ..... **$3.00** ea.

Ohmite Model J-1000 ohm, 50 watt
New Price ..... **$2.95** ea.

Ohmite Model J-150 ohm, 50 watt
New Price ..... **$2.95** ea.



CIRCUIT BREAKER

Heinemann 2163M4 1.25 amp. 117.5 V. 2 pole AC. Curve 3 size 5¼"x4"x3". Shipping weight 2½ lbs.
New Price ..... ea. **$2.70**

STORAGE BATTERY 6 V. 34 AH

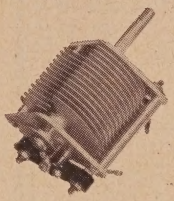
3-TA5-9B—Manufactured by Exide Battery Co. for aircraft. Size 5" x 5" x9" overall. Shipping weight 15 lbs. New dry charged. Fill with 1.265 sp.g. sulphuric acid.
Price ..... ea. **$6.25**

MULTI-SECONDARY FILAMENT TRANSFORMER

9 secondary 6.3 V. at .01-3 amps. One sec. 2½ V at 2½ A; one sec. 2.5 V. @ 10 A. Two sec. 2.5 V @ 5A; Two 5 V. @ 3 A. 110 V. 60 cycle primary —up to 5000 V. ins. test. Size 5"x 5¾"x6½" H. Shipping weight 21 lbs.
New Price ..... ea. **$3.95**

BRAND NEW 12 V. DYNAMOTORS

DM-40 Input: 12-14 V. 3.4 A. Output: 172 V. -138 MA. Here is an ideal dynamotor to adapt to mobile uses on the new 12 V. cars. Don't pass up this buy even if your intended uses are not immediate. Size 6¾" L x 3½" dia. 4" lead with 6 pin Jones plug. Shipping weight 7½ lbs.
New Price ..... ea. **$2.75**

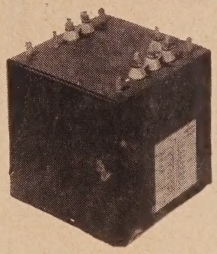


VARIABLE CONDENSER

Freq. Meter type, 245 MMFD. 27 plate mdgt. type. Gold plated heavily constructed. Approximately 3"x2½"x1¾" overall size with 1¼"-¼" shaft extension. Shipping weight 1 lb.
New Price ..... ea. **$1.25**

H. V. TRANSFORMER

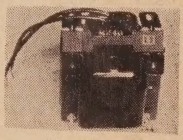
Output 1500 V., 5 MA and 6.3 V. at .6A 5000 V. test and 2.5 V. at 1.75 A. Input: 115 V. 60 cycles. Size 4½"x5" x⅜" Shipping weight 6 lbs.
New Price ..... ea. **$3.50**



TRANSFORMER PLATE POWER

355-0-355 Volts @ 325 Ma. Also 490 V. 325 Ma. Primary 117 Volts 60 cycle. Measures 5" x 5½" x 6". Shipping wt. 22 lbs. PRICE **$2.95**

CHOKE



12 henry 200 ma. 160 ohms DC res. 3000 V. test ins. size 3¼"x 3⅞"x4¾". Shipping weight 7 lbs.
New Price ..... ea. **$2.25**

AN-80 ANTENNA

465 Mc. Antenna which may easily be trimmed for amateur use. Easily mounted for mobile use. Includes rubber gasket for rooftop. Matches 52 ohm cable, coax cable fitting included
NEW..... **79c** ea.

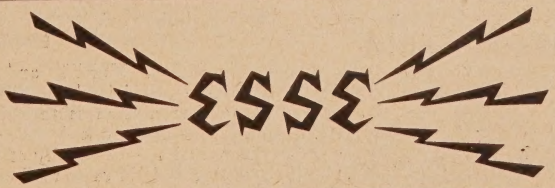
110 V. AC SOLENOID

New 110 V. AC solenoids with ⅜" dia. steel plunger with ⅜" travel. The terrific pull on this plunger makes it ideal for door locking mechanisms. Only 200 in our inventory. **95c** ea.

KNOB AND DIAL PLATE

Calibrated 100-155 M.C. brass plate attached to knob by 3 screws allowing reversal and recalibration for 38" shaft. Shipping wgt. 1 lb. New Price **25c** ea.

40 West South Street



Indianapolis 4, Indiana

CRYSTALS!

ALL HAM FREQUENCIES

Individually. Ea. ..... $ .79
In lots of 5. Ea. ..... .69
In lots of 10. Ea ..... .59
SINGLE SIDE BAND CRYSTALS. Ea. ..... .69

COMPLETE SET — 80 CRYSTALS

Ranging from 370-516 Kc., 54th Harmonic. INCLUDING 500 Kc. & 455 Kc. crystals. Only ..... Per set **$6.95**

COMPLETE SET — 120 CRYSTALS

Ranging from 370-540 Kc., 72nd Harmonic. INCLUDING 500 Kc. & 455 Kc. crystals. Only ..... Per set **$9.95**

200 KC. CRYSTAL ..... Ea. $1.49
500 KC. CRYSTAL ..... Ea. .75

CRYSTAL GRINDING KITS
With Instructions

80 METER KIT $6.95
40 METER KIT 5.49
2 METER KIT 5.49

$600 VALUE! SPECIAL! HOT!!

A TRANSCEIVER WITH A RAFT OF USES! Makes an ideal 2-Meter transmitter. Only a few of its many parts include: miniature blower, gear reduction motor easily converted to 110 VAC, over 40 miniature tube sockets, 7 panel coaxial fittings, microswitches, & MUCH MORE! Excellent condition. Original cost over $600! IT'S ALL YOURS FOR ONLY.... **$9.95**

MS-53 INTERCHANGEABLE ANTENNA MAST

New, Per 3 ft. section ..... Ea. **97c**

0-1 THREE-INCH MILLIAMP METER

270° indication. You just by-pass shunt and add scale. ONLY **$1.95**
WITH Shunt By-passed **2.49**

ARB NAVY RECEIVER. Excel. cond. $27.50
SCR-518 UHF ELECTRONIC ABSOLUTE ALTIMETER. New. Less tubes $19.95
TELEPHONE DIAL. Used, excel. cond. 1.75
LATEST TYPE FIELD PHONES. Excellent condition. PER PAIR $19.50

400 MICA CAPACITORS. Assorted. Mounted 10 to a strip. All 400 ..... 1.95
ARW-2 REMOTE CONTROL RECEIVER. NEW... 27.50
Items subject to prior sale. Send for FREE Catalogue!
All merchandise sold as is

J. J. GLASS ELECTRONICS CO.
1615 S. MAIN ST. LOS ANGELES 15, CALIF.

MOBILES ATTENTION

6 VOLT HIGHWAY SAFETY KIT Made by WESTINGHOUSE. Complete with snap-on stand & sealed beam headlamp which can be used as spare headlight. Scotchlite "CAUTION" sign. Plugs into cigarette lighter. ALL NEW AND BOXED **$3.00**
POSTPAID ANYWHERE IN U.S.A.

DRILLICK ELECTRONIC SALES CO.
5279 WEST PICO BLVD. LOS ANGELES, CALIF.

— THIS MONTH'S SPECIALS —

SPEAKER-TWEETER Used on Beachmaster Amplifier. Has 2" Voice Coil. Response to 20,000 Cycles. Will Handle up to 50 Watts. Complete with Spare Cone. 8 Ohms. Weight 4½ lbs. **$9.95**

VIBROPACK, PE-204: Input 12VDC/0.58 Amp. Out: 2X4.3V/50MA, 2X45VDC/0.5MA. 2X85VDC/5MA. New, Complete with Spare Vibrator. Well-Shielded and Portable. Weight approx. 10 lbs. **$4.75**

Send Check or M.O. Ship. Chgs. C.O.D.
COMMUNICATIONS EQUIPMENT CO.
131 Liberty St. Dept. Q-9 New York 7, N.Y.

8 WIRE CONTROL CABLE

Two No. 16, Six No. 20 tinned stranded copper, rubber insulated coded leads. Waterproof rubber jacket. Woven tinned copper armor shield overall. Dia. 7/16 inch. Continuous lengths up to 400 ft. Minimum order 100 ft. Shipped Express only, charges collect, F.O.B. Chicago Warehouse. PRICE ..... **6c ft.**

TRANS-WORLD RADIO-TELEVISION CORP.
6639 S. ABERDEEN ST. CHICAGO 12, ILL.

DX OVERSEAS NEWS

(from page 25)

May 20, 1954, OK? Let's hear from you . . . June's solar eclipse reminds us that there will be another eclipse of the sun, visible in South Africa, on Christmas Day. It is hoped that ZS2RU will be running continuously on the 7, 14 and 21-Mc. bands for this period. The help of many transmitters and listeners is required and all willing to cooperate should write, before Oct. 1 to A. P. Dale, ZS2JW, Ionosphere Research Laboratory, Rhodes Univ., Grahamstown, C.P., Union of South Africa (from "Short Wave Magazine").

VHF NEWS

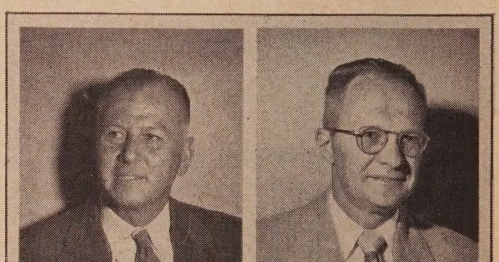
(from page 39)

September 18 and 19. Mt. Davis is the highest point in the state of Pennsylvania with an elevation of 3210 feet. It is located near Meyersdale, 65 miles airline southeast of Pittsburgh and about 5 miles north of the Maryland-Pennsylvania state line.

Plans at this writing call for operation on the 2-meter and 420-Mc. bands. Frequencies will be 144.03, 144.19, 144.40 and 432.5 Mc. The power on 2 meters will be 100 watts into a "Brownie" beam while on 420 they plan on 40 watts into a 32-element beam. The operation will be mostly horizontal on 420, as well as 144 Mc. The converter on the 420-Mc. band will be a W2QED trough line job. The operators will divide the duties between W3SST, W3QFM and W3OCI.

SPARE PARTS

Ramon Cantarrana, CO3RC has been appointed Director of the National Emergency Net for the Radio Club of Cuba. CO3RC will also act as Net Control. The eight call areas of the island have also been assigned Provincial Net Control Stations and they are as follows: CO1EC (Pinar del Rio, zone 1), CO2CH (Havana, zones 2, 3 and 4), CO5PN (Matanzas, zone 5), CO6ED (Las Villas, zone 6), CO7KK (Camaguey, zone 7) and CO8DL (Oriente, zone 8). The frequencies in use will be between 3730 and 3790 kc. in the 80-meter band and 7010 and 7060 kc. in the 40-meter band.



W6KM (left) and W6BET (right) recent additions to the EIMAC staff.

Byron Ballou, W6BET and William McAulay, W6KM have just joined the Field Engineering staff of Eimac, famous manufacturer of transmitting tubes. W6BET has also worked with the Globe Wireless Company and the University of California Radiation Laboratory. W6KM came to Eimac from the National Broadcasting Company.

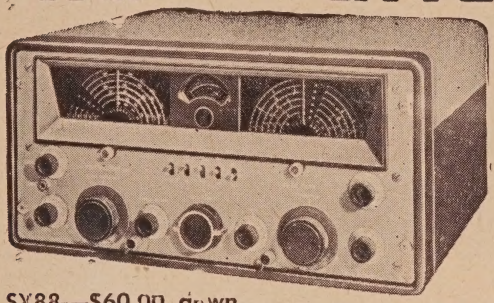
YOU GET

From **Henry**

Bob Henry,
WØARA
Butler, Mo.

Ted Henry
W6UOU
Los Angeles

hallicrafters



HERE'S WHY!

- Top Trades
- Only 10% Down
- Easy Terms
- Fast Delivery
- Personal Service
- Low Prices
- Complete Stocks
- We *want you* to be satisfied. Ask any Ham about Henry. And Henry has the new equipment *first.*

SX88—$60.00 down

18 monthly payments of $32.40—$595.00 Cash Price

SELECTIVITY—For the first time, selectivity from 10 KC to 250 cycles in six steps. Single side band suppressed carrier.

SX71

$25.00 Down

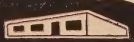
18 monthly payments of $13.60
—$249.95 Cash Price.

For top performance with extra pull power and ability to tune in stations. Covers broadcast bank 560-1600 KC plus four short-wave bands covering 1650 KC-34 MC and 46-56 MC.

	Cash Down	18 Monthly Payments	Cash Price
S53A	$10.00	$ 5.45	$ 99.95
S40B	12.00	6.54	119.95
S76	20.00	10.89	199.95
SX62A	35.00	19.07	349.95
HT20	45.00	24.50	449.50

Write, wire, phone or visit either store today.

Butler 1, Missouri
Phone 395



Henry Radio Stores

BRadshaw 2-2917
11240 West Olympic Blvd. Los Angeles 64

LOOKING FOR DX? GET A GOTHAM BEAM AND WORK THE WORLD!

Reports tell the story of GOTHAM BEAM performance —you can work more DX in a day off a GOTHAM BEAM than in a year off a wire or dipole. GOTHAM BEAMS are strong, too; easy to assemble and install, no special tools or electronic equipment necessary; full instructions included, matching is automatic; maximum power gain built into the design—AND ALL AT LOW, LOW, PRICES.

NEW! NEW! NEW! 2-METER BEAM KITS

GOTHAM proudly presents a 6 element Yagi beam for 2 meters at only $9.95. Contains a 12 foot boom, 1" alum. tubing; ⅝" alum. tubing for elements; Amphenol fittings; all hardware, and instructions. Vertical or horizontal polarization, terrific performance!

And GOTHAM'S new 12 element Yagi for 2 meters at only $16.95! Contains a 12 foot boom, 1" alum. alloy tubing; ⅝" tubing for elements; all Amphenol fittings; all hardware, and instructions. Vertical or horizontal polarization, multiplies your power by 32!

10 M. BEAMS

S103T - Std. 10m 3-El. T match, $18.95. 1—8′ Boom, ¾" Alum. Tubing; 3—6′ Center Elements, ¾" Alum. Tubing 6 — 6′ End Inserts ⅝" Alum. Tubing; 1 — T Match (4′), Polystyrene Tubing; 1—Beam Mount.

D103T - DeLuxe 10m 3-El. T match, $25.95. 1—8′ Boom, 1" Alum. Tubing; 3—6′ Center Elements, 1" Alum. Tubing; 6—6′ End Inserts, ⅞" Alum. Tubing; 1 — T Match (4′), Polystyrene Tubing; 1—Beam Mount.

S104T - Std. 10m 4-El. T match, $24.95. 1—12′ Boom, 1" Alum. Tubing; 4—6′ Center Elements, ¾" Alum. Tubing; 8—6′ End Inserts, ⅝" Alum. Tubing; 1 — T Match (4′), Polystyrene Tubing; 1—Beam Mount.

D104T - DeLuxe 10m 4-El. T match, $30.95. 1—12′ Boom, 1" Alum. Tubing; 4—6′ Center Elements, 1" Alum. Tubing; 8—6′ End Inserts, ⅞" Alum. Tubing; 1 — T Match (4′), Polystyrene Tubing; 1—Beam Mount.

15 M. BEAMS

S152T - Std. 15m 2-El. T match, $22.95. 1—12′ Boom, 1" Alum. Tubing; 2—12′ Center Elements, ¾" Alum. Tubing; 2—5′ End Inserts, ⅝" Alum. Tubing; 2—7′ End Inserts, ⅝" Alum. Tubing; 1—T Match (6′), Polystyrene Tubing; 1—Beam Mount.

D153T - DeLuxe 15m 3-El. T match, $39.95. 1—12′ Boom, 1" Alum. Tubing; 3—12′ Center Elements, 1" Alum. Tubing; 2—5′ End Inserts, ⅞" Alum. Tubing; 2 — 6′ End Inserts, ⅞" Alum. Tubing; 2—7′ End Inserts, ⅞" Alum. Tubing; 1—T Match (6′), Polystyrene Tubing; 1—Beam Mount.

20 M. BEAMS

S202N - Std. 20m 2-El. (No T), $21.95. 1—12′ Boom, 1" Alum. Tubing; 2—12′ Center Elements, 1" Alum. Tubing; 4—12′ End Inserts, ⅞" Alum Tubing; 1—Beam Mount.

S202T - Std. 20m 2-El. T match, $24.95. 1—12′ Boom, 1" Alum. Tubing; 2—12′ Center Elements, 1" Alum. Tubing; 4—12′ End Inserts, ⅞" Alum Tubing; 1 — T Match (8′), Polystyrene Tubing; 1—Beam Mount.

D202N - DeLuxe 20m 2-El. (No T), $31.95. 2—12′ Booms, 1" Alum. Tubing; 2—12′ Center Elements, 1" Alum. Tubing; 4—12′ End Inserts, ⅞" Alum Tubing; 1—Beam Mount. . .

D202T - DeLuxe 20m 2-El T match, $34.95. 2 — 12′ Booms, 1" Alum. Tubing; 2—12′ Center Elements, 1" Alum. Tubing; 4—12′ End Inserts, ⅞" Alum. Tubing; 1 — T Match (8′), Polystyrene Tubing; 1—Beam Mount.

S203N - Std. 20m 3-El. (No T), $34.95. 1—12′ Boom. 1" Alum. Tubing; 3—12′ Center Elements, 1" Alum. Tubing; 6—12′ End Inserts, ⅞" Alum Tubing;1—Beam Mount.

S203T - Std. 20m 3-El. T match, $37.95. 1—12′ Boom, 1" Alum. Tubing; 3—12′ Center Elements, 1" Alum. Tubing; 6—12′, End Inserts, ⅞" Alum. Tubing; 1 — T Match (8′), Polystyrene Tubing; 1—Beam Mount.

D203N - DeLuxe 20m 3-El. (No T), $46.95. 2—12′ Booms, 1" Alum. Tubing; 3—12′ Center Elements, 1" Alum. Tubing; 6—12′ End Inserts, ⅞" Alum. Tubing; 1—Beam Mount.

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ALL ABOUT IMPEDANCE BRIDGES

(from page 45)

countered are the signal source and the detector. In considering the signal source, any a-c frequency may be used with 1000 cycles offering a fair compromise. If frequencies in the high audio region are used, troubles are encountered with stray capacity couplings in the bridge and associated wiring. The low frequencies such as 60-cycle power line supplies are used in many small bridges and perform quite well except that it becomes more difficult to measure very small capacities if a high degree of accuracy is desired.

Another concern in bridge design is the amount of voltage to be applied. In the

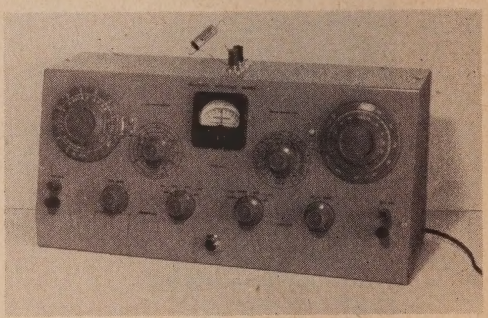

Fig. 5. The signal generator portion of the Heathkit IB-2 Impedance bridge. The d-c filament voltage is obtained from built-in rectifiers.

measurement of certain high impedance components a high voltage may be required. Other measurements may require a low voltage. Under these varying conditions it is an easy matter to burn out a standard resistor or calibrated potentiometer unless precaution is taken.

These supply difficulties are solved in the *Heathkit IB-2* by using a built-in oscillator. This signal source consists of a stable two-tube 1000-cycle oscillator. This is of the phase shift type and uses quick heating filament type tubes (see *Fig. 5*). The filaments are operated from a rectified a-c power supply which means that the instrument is ready for instant use. The gain control incorporated in the signal source allows complete level control; however, an error in level cannot injure the bridge as the small tubes do not have enough power output to do any damage. The audio output

(Continued on page 56)

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1195	2480	2830	3095	6040	6625	7640	8040
1525	2485	2835	3100	6042	6640	7650	8041.7
1900	2490	2840	3110	6050	6650	7660	8050
1915	2495	2845	3130	6073	7000	7666.7	8058.3
1930	2505	2850	3135	6075	7006	7670	8060
1940	2510	2855	3140	6100	7025	7680	8066.7
1950	2515	2860	3145	6106	7040	7690	8070
1965	2520	2865	3150	6125	7050	7700	8073.3
1977	2525	2870	3155	6140	7073	7710	8075
2015	2530	2875	3160	6142	7075	7720	8080
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2020	2545	2885	3170	6173	7106	7740	8090
2025	2550	2890	3175	6175	7125	7750	8091.7
2035	2557	2895	3200	6185	7140	7760	8100
2040	2560	2900	3202	6200	7150	7770	8106.6
2055	2565	2905	3205	6206	7165	7780	8108.3
2060	2570	2915	3210	6225	7173	7783.3	8110
2065	2575	2920	3220	6235	7175	7790	8116.7
2090	2580	2925	3225	6240	7200	7800	8125
2105	2585	2930	3230	6250	7206	7810	8130
2125	2590	2935	3235	6273	7225	7820	8133.3
2130	2595	2940	3240	6275	7240	7830	8140
2135	2650	2945	3290	6300	7273	7840	8141.7
2140	2655	2950	3300	6306	7275	7850	8150
2195	2660	2955	3310	6315	7306	7860	8158.3
2300	2665	2960	3320	6325	7300	7870	8160
2305	2675	2965	3340	6335	7325	7880	8163.4
2320	2680	2970	3410	6340	7340	7891.7	8166.7
2350	2685	2975	3420	6350	7350	7890	8170
2355	2690	2980	3455	6362	7375	7900	8173.3
2360	2695	2985	3465	6373	7400	7910	8180
2365	2700	2990	3500	6375	7406	7920	8183.3
2370	2705	2995	3525	6405	7425	7930	8190
2375	2710	3005	3640	6406	7440	7940	8191.7
2390	2715	3010	3655	6425	7500	7950	8200
2415	2720	3015	3680	6440	7510	7960	8206.6
2430	2750	3020	3700	6450	7520	7970	8208.3
2435	2755	3025	3760	6473	7530	7980	8210
2440	2760	3030	3800	6475	7540	7990	8216.7
2442	2765	3035	3885	6500	7550	8000	8220
2450	2770	3040	3940	6506	7560	8006	8225
2455	2775	3045	3955	6525	7570	8008.3	
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1810	2220		2851	3297	3702.5	3950	4210
1830	2235	2510	2853	3311	3705	3960	4215
1850	2240	2514	2894	3317	3710	3965	4235
1870	2255	2527	2895	3365	3730	3985	4240
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1910	2275	2559	2925	3390	3750	4012.5	4275
1930	2280	2586	2926	3395	3760	4015	4280
1950	2295	2587	2960	3412.5	3765	4020	4305
1970	2300	2605	2971	3422.5	3770	4030	4310
1990	2315	2625	2980	3462	3775	4035	4325
2010	2326		3000	3480	3790	4050	4335
2030	2335	2643	3010	3485	3792.5	4055	4345
2050	2340	2665	3023	3500	3807.5	4065	4350
2075	2355		3027.5	3520	3825	4080	4370
2082	2360	2685	3055	3540	3830	4085	4380
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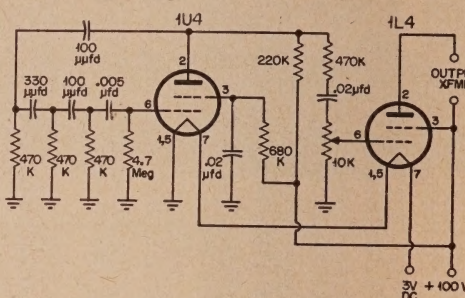
(from page 52)

transformer will be of special interest to those who are not accustomed to this type of bridge. This is a special transformer used to couple the signal source to the bridge proper. In its design care has been taken to eliminate as much as possible the capacity coupling between primary and secondary and to keep the secondary balanced to ground.

As mentioned previously, detector sensitivity is very important in the operation of any bridge. The output on the extreme ranges may fall below satisfactory operating level as the null is approached. This gives the equivalent of a broad null and reduces accuracy. This has



The Heathkit IB-2 impedance bridge.

been overcome in this particular instrument by adding a built-in audio amplifier. Enough gain is realized in the two stages to operate the zero center meter (see *Fig. 6*). When operating the meter the output of the amplifier is first rectified and then applied to the meter. This gives a very sensitive indicator and is much more convenient to use than a pair of phones. The tubes in the amplifier are also of the quick heating type.

All power for operating the instrument is taken from the 60-cycle power line. Two sets of selenium rectifiers are used to furnish the various d-c voltages required. By using selenium rectifiers no warm up time is required and this in connection with the quick heating tubes gives an instrument that is ready for immediate use. Because of the switching system which can complicate a drawing when drawn out completely, the entire schematic will not be shown.

For those who assemble this particular kit, a precision resistor is included to be used as a method of calibration. By using this and the method suggested the instrument can be calibrated. Some of the more serious-minded experimenters will probably want to plot a more accurate calibration of the capacity ranges, especially the lower values which fall in the tuning condenser ranges. If no standard capac-

(Continued on page 58)

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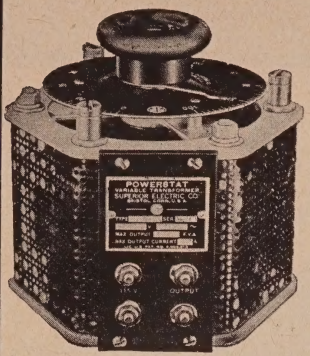

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(from page 56)

itors are available for such a check, one source of supply available to most Hams is the old BC-375 surplus transmitter. In several of the tuning units high voltage mica capacitors were used in the tuning circuits. Many of these still hold their capacity within 1% or better and may be used for spot checks.

When using a bridge such as this it should be remembered that with no connections to the "unknown" or X terminals, zero capacity *will not* be indicated by the dial. Even though buss wire is used to wire the bridge proper, there is still enough residual capacity in the wiring to show on the scale. This residual capacity may show up as any value from 2 or 3 microfarads to as high as 15 or 20 depending upon the wiring job done by the constructor.

The calibrated ranges of this instrument run as follows:

Capacitance—10 $\mu\mu$fd. to 100 μfd.
Resistance—0.1 ohm to 10 megohms
Inductance—10 μh. to 100 henries
Dissipation factor *(D)*—0.002 to 1
Storage factor *(Q)*—0.1 to 1000

Little will be said regarding operation of this instrument. Measurements are so simple that anyone who can assemble the kit can operate it at first trial.

This discussion of the *Heathkit* impedance bridge has been kept as factual as possible. Perhaps this does not make for exciting reading but a bridge is something that does not have to be "sold" to the serious Ham.

Editor's Note: This concludes the eight part series entitled, "Test Equipment in the Ham Shack." Reader comments are welcomed and suggestions for additional material would be appreciated.

TRANSISTORS

(from page 33)

current is no longer 500 microamperes *but has risen to 5 milliamperes!* Here is clearly an indication of a current gain of 10 to 1. It is to be remembered that the foregoing values are for tests with a typical CK722 transistor and may depart somewhat with different transistors of the same type, and at a different temperature. Care must be taken in setting the resistance of the potentiometers *R1* and *R2* in the circuit at the beginning of each test and gradually altering each resistance carefully to protect the

transistor. Voltage values were read with a vacuum tube voltmeter.

Figure 2d should help in understanding this phenomenon known as transistor action. As previously mentioned it is attributed to current conduction by holes, which may be considered as positively charged particles. Changes in the electron flow in the emitter will produce an injection of holes, or positive charges. Any variation in the number of holes from the emitter will vary the quantity of holes moving on to the collector layer, via the base. In other words, a battery potential, or a signal voltage, impressed across the emitter-base circuit will determine the supply of these positive charges that pass through the junctions of the germanium crystal. These positively charged particles, or holes, are naturally attracted to the collector because of the negative bias at this point as supplied by the battery *B2*. The positively charged holes in the vicinity of the collector attract additional electrons to this area, which results in a lower resistance path and increased current in the collector circuit. It may be said that these holes permit electrons to move more freely from the collector junction through the base of the germanium structure, thereby contributing to greater current flow through this path.

In checking back it will now be seen that the familiar concept of electron theory may be applied to the illustrations given in *Figs. 2b* and *2c*, but in order to explain the condition of current gain resulting in *Fig. 2d*, the additional concept of electric current conduction by means of "holes" or positive charges must be visualized.

Transistor Testing

Incidentally, the test setup shown in *Fig. 1* has proven useful in testing the condition of transistors. A CK722 which had been subjected to overload, due to a short circuit in a transistor device, was checked with this setup. It was found that under the same operating conditions as described previously in this article for a good CK722, the collector-base current flow of the defective CK722 was only 75 microamperes instead of 500. The emitter-base current was normal, indicating that damage must have resulted in the collector path when the short circuit occurred.

Figure 3 shows the three basic connections for transistors, both point contact and junction types. At the top is the grounded base connection, below is the grounded collector arrangement, and just below that the grounded emitter configuration. Shown also, bottom, is a symbol that is sometimes used to indicate junction transistors, only. It will be noticed that the arrow points away from the base rather than toward it as in the other figures. This is because there is a difference in the direction of

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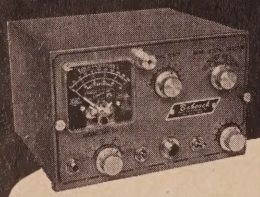

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base current flow in the two types. Base current in point contact type flows into the base. In the junction type, base current flows out of the base.

Numerous experimental and practical applications of transistors are being published by leading magazines. To become well acquainted with transistor action and circuitry it is strongly recommended that the student and experimenter construct and operate these various devices and study their behavior. It is well to add a word of caution in this connection. The transistor, although rugged and of long life when correctly employed in circuitry, can be very easily ruined if improperly handled. Correct supply voltage polarities must be strictly observed. Heat transfer to the crystal structure must be avoided, and the operating ratings recommended by the manufacturer must not be exceeded.

The transistor art offers a virgin and extremely intriguing field of experimentation to the student and electronic investigator. It is hoped that what has been offered in this article will contribute something in the way of assisting those interested in the principles of transistor operation.

YL's FREQUENCY

(from page 30)

clubs and D/C of the district that has the largest increase. This will run September through May—so let's all bring in some new members.

A new edition of the YLRL Callbook (first published in 1949) is planned for publication at the end of the membership drive.

Another big possibility is a YLRL National Convention at Los Angeles next June or July. Surely this year will go down as a big one in YLRL's history!

LARKs

At their June meeting **LARK** members elected new officers, who will be installed in September. (No club meetings are held in July-August.) Taking over for the coming year will be **W9YBC**, Gloria, president (see above); **W9SYX**, Peggy, vice president; **W9YXK**, Rita, sec'y-treasurer; **W9MYC**, Gladys, publicity chairman; **W9TMZ**, Rosemary, editor of **Pinfeathers**, and Novice representative.

In May the **LARKs** welcomed former club member Verona, W5ZUD (ex-WN9QYG), with a luncheon. W9LOY, Cris, was hostess, with all the girls contributing. Also in May, many of the **LARK** members attended the fourth annual get-together of the 9th district YLs in Milwaukee. The convention brought together these YLs: W5ZUD, Verona; W8ATB, Esther; W9's GMT, Lenore, RUJ, Mary; LOY, Cris; SPI, Marge; SYX, Peggy; ZAD, Alma; QMA, Dorothy; OMZ, Jeanne; YWH, Evelyn; LRT, Julie; YBC, Gloria; VCE, Betty; AYX, Jackie; IKS, Edna; ZBA, Marian; WYJ, Florence; SJR, Bernice; YXK, Rita; BCB, Helen; WØJKZ, Lydia, and ten unlicensed YLs. The **LARKS** have accepted the task of sponsoring the W9 convention at Chicago next year.

Chicago YLRL

At their June meeting also the members of the Chicago unit of YLRL elected new officers, to take over in July. **W9SEZ**, Eleanor, was elected president; **W9SSL**, Shirleen, vice president, and **W9GME**, Grace, sec'y-treasurer. The club recently dedicated its own club station, **W9DEQ**. Located at Gompers Park Fieldhouse, it now consists of a 2-meter station donated by **Motorola**,

and will soon have an all-band transmitter. Active club members are W9FRO, MYC, SPI, SSL, SEZ, GME, AYX, RXY, BCB, QV, RGK, TIX, OTM, OTO, and WOI. Five others are working toward licenses and the club plans to hold regular code and theory classes for would-be YLs. W9GME, Grace, has been awarded a $300 scholarship on television technical practice to the Northwest Radio and Television School. The school is opening a Chicago office and Grace will probably use the scholarship to brush up on her radio theory.

SK

We've done it again—yep, another new QTH! Early in July the OM was fortunate enough to get a house at Towaoc where he works, so here we are. Once again we'll have plenty of space for Ham gear and antennas—and we hope no TVI. So we'll be looking for you on the air. 33, WØSCF

NOVICE SHACK

(from page 28)

themselves. Furthermore, by measuring voltage at different positions between them, it will be discovered that it varies in a smooth curve, which is called a **standing wave.** (See **Fig. 3.**)

The ratio between minimum and maximum voltage on the line is called its **standing wave ratio** (SWR). SWR can also be defined in current ratios or in impedance ratios. All give the same answer.

Referring to the SWR chart in the **Handbook,** we find that a 10:1 SWR on a line that has about 0.2 db. losses when matched will increase the losses an additional 0.7 db. And an 0.3 db. loss will be increased an additional 1 db. As a 1-db. power loss results in a barely detectable loss in signal strength, the losses introduced by operating the 300-ohm line in this manner are tolerable on both bands. A line longer or shorter than 100 feet would have proportionately higher or lower losses.

On 3.5 Mc., the mismatch with RG-58/U cable will be only 53/30, or 1.4 to 1; therefore, its losses will not be measurably higher than if it were perfectly matched. But on 7 Mc., the mismatch will be 60 to 1. As a result the normal loss of 0.8 db. per 100 feet at this frequency will be increased an estimated 8 db., meaning that about 90 per cent of the power fed into the line will never reach the antenna, and with high power, the line would probably "burn up."

Other lines and antenna impedances can be similarly analyzed. If the additional loss caused by the mismatch does not exceed 1 db., the mismatch can be tolerated, provided the resulting current and voltage peaks do not exceed the rating of the line. In round figures, the last factor reduces the maximum power a line will carry safely by 70 per cent every time the SWR is doubled. For purposes of comparison, the smaller transmission lines will safely carry about 600 watts when properly matched.

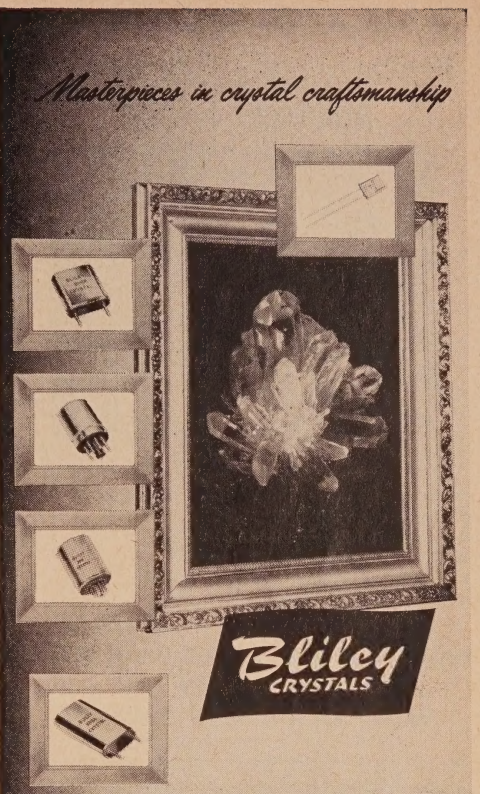
The previous discussion assumed that the antenna was exactly resonant at the operating frequency. If it is not, it will introduce a reactance into the line that will increase the SWR and will move each voltage minimum or maximum closer to the antenna (antenna too short) or further from it (antenna too long).

The term **electrical length** is often used in discussing transmission lines. Because radio waves do not travel as fast on them as they do in space, a wave does not travel as far in one cycle on a transmission line as it would in free space. To compensate for this fact, free-space lengths are multiplied by a velocity-of-propagation constant. This gives the equivalent line length. This constant is always included in tables giving data on various transmission lines.

Incidentally, you can tell if a transmission line has standing waves by changing its length a few feet. If doing so requires changing antenna coupling to retain the same transmitter input, the line has standing waves.

News From Novices' Shacks

Marjorie Hess, WN9FGC, of Hammond, Indiana, writes: "I received my license after perhaps two months



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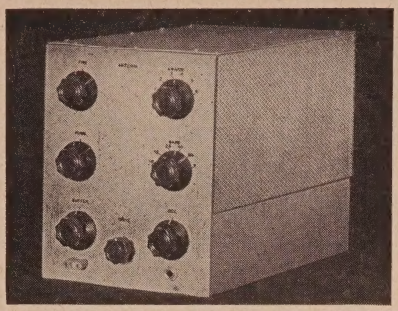

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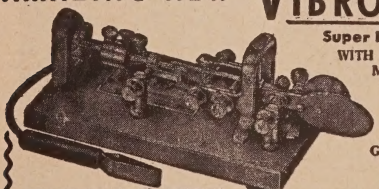

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(from page 61)

of study of code and theory. My 6AG7-807 transmitter, 1-tube receiver, and monitor are all home-made. Naturally, I had help. Blood, sweat, and tears furnished by WN9EWG and soldered joints by me, and not one cold joint in the lot! The receiver was built primarily for practical experience and as an aid in learning the code. It has continued to find use as the regular station receiver. It is not the ideal receiver, but I have made some thirty contacts in five states (confirmed) with it. TVI keeps my operating time down; so I don't know just how well it might do . . . I'm still surprised to find myself involved in anything so far removed from the usual feminine hobbies. WN9EWG, who got me into this, insisted that it's fun (true) and 'you can do it, Marge' attitude. (Still in doubt.)"

Bob, **WN4ZTW**, reports from Jacksonville, Fla. "My license is about to expire, but I have had fun working 26 states—all of the eastern states, except some of New England. My transmitter is a **TR-75** and my receiver is an **NC-88**. I'd like to hear from YL's 18 to 19 years old."

Lloyd, **W5AOV**, Lafayette, La., has not wasted any time either. "I have just received my 'General' after 10 months as a Novice. In that time, I worked 41 states Canada, Puerto Rico, Cuba, New Zealand, and Hawaii, all on 40 meters. I use a **Globe Trotter** transmitter running 40 watts, and **S-40** and **BC-224** receivers . . . I am 16 years old and am in the eleventh grade. I have a 20-w.p.m. code certificate."

Ron, **W3VLL**, gives news of interest to prospective amateurs around Baltimore. "I notice the trouble many fellows have in learning the code. I would like to advise them that my good friend Al Bowen, ex-3KH, is willing to teach all interested parties the code at no charge. Just stop by any week night at 1723 E. Oliver St., Baltimore, Md., or telephone me at ID-5-9109."

Frank, **WN4DYV**,/**W4DYV**, Petersburg, Virginia, has a goal. "I have had my Novice and Technician licenses for three months now and have worked 30 states so far. I'll probably never do it as a Novice with my 35 watter, but my goal is to work all states. I can work both 3.7 Mc. and 7.2 Mc., but I can't see that 7.2 Mc. is any better than 3.7 Mc. for DX. I've yet to hear a foreign amateur in the Novice bands. Just for kicks, though, I'd like to try a schedule with a California station. I've heard plenty on 7.2 Mc., but they never answer my calls."

Jeff, **WN1ZXF**, of Providence, R.I., is 14 years old. He writes, "I have been on the air only five days with a 7-watt rig and a 120 foot antenna, and I have worked 4 states." He then asks how to get rid of key clicks, but included no address in his letter!

"Shack," **W2HNG**, makes an announcement that should interest all beginning amateurs in the NYC area. "I have arranged with the NYC Board of Education for a tuition-free course in practical transmitter construction at the Queens Evening Trade High School. Applicants must possess at least a Novice license (or equivalent) and be 17 or older. Applications must be in my hands before October 1. Send them to: W2HNG, Box 131, Jamaica, L. I., N.Y."

Steve, **WN7VEW**, Provo, Utah, says: "I have been on the Novice bands, without missing a day, since January

(Continued on page 64)

Help Wanted

Each month CQ lists those names and addresses of prospective Novices and Hams needing assistance with code or theory. To have your name listed, please address your request to W9EGQ, 385 Johnson Street, Gary 3, Indiana.

Steve Shaffer (14), 44302 Third Street, **Lancaster, Calif.**
Edwin Winet (15), 3771 Dover Place, **Los Angeles 39, Calif.**
Larry Benfield (15), Route #1, **Mt. Villa, North Carolina.**
Eddie Golemboski, Jr., (13), 251 North St., **Middletown, N.Y.** Telephone: 22081.
Ed Lafreniere, 5215 Hollywood Drive, **Decatur, Ga.,** Telephone: EV 0332.
Sam Sussman, 6084 Jeanne Mance, **Montreal 8, Que., Canada,** is organizing a club for SWL'ers and would-be Hams.

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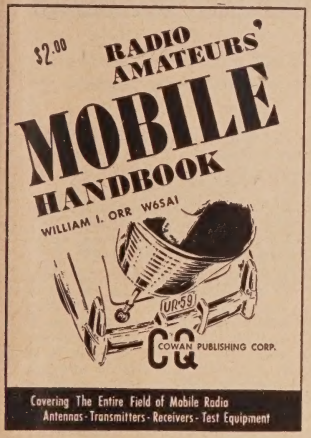

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(from page 62)

6. Most stations I work say I am their first Utah contact. I operate on 7185 kc. with 75 watts input and on 3735 kc. with 20 watts input, and will be glad to work and send a card to anyone needing Utah. Incidentally, I hope that KL7BB sends me a card."

Bud, **WN4FGI**, Clearwater, Fla., says: "In 3 weeks on the air, I've had 57 contacts (one YL) with my **TR-75**, ¼-wave antenna and **S-40B** receiver. The other day, I was chatting with a station when a very bad noise came on, and I could no longer copy him; so I told him so and signed. I could just barely hear him come back under the noise, but from what I could copy of his transmission, he was very bitter about me signing off with him. I should think anyone would be glad to sign with a station who could not copy him!"

Dick, **WN3ZDE**, Beaver Falls, Pa., reports, "I have been a Novice 28 days and have worked 27 states and

Marge, WN9FGC, is still surprised to discover that she is a Ham, but she's very happy.

two Canadian provinces, but I'm not satisfied. I want to try 21 Mc. now. My transmitter is a **Globe Scout 40A**, running 60 watts, and the receiver is an **S-38C**, with an NC-98 on the way."

Bob Yates, **WN4GCB**, 7 Victory Dr., Sumter, South Carolina, works 3.7 Mc. and 7.2 Mc., but being a 'DX hound,' likes 7.2 best. He would like to hear from others in his vicinity interested in forming a radio club.

Cletus, **WN3WUA/W3WUA**, 58 East 8th Ave., Clarion, Pa., claims: "I'm one of those fellows who have to make with the sweat and tears for a QSO. In 6 months operation, I've gotten 10 cards out of 19 contacts in 5 states. The transmitter is a 6F6/1625 that runs between 10 and 25 watts, when it feels like it. The receiver is a souped-up **S-38C** . . . Once, I copied **WN8PUC**'s address incorrectly, and after sending a couple of QSL cards, a YL sent me a postal card, wanting to know how I got her address and why I kept sending her 'radio' cards . . . If there are any teen-age Hams around here, please drop me a card."

WN8OJR's suggestion that we have a friendly competition to determine the ages of some of our older Novices has brought out the following additional entries: Larry, **KN2GQA**, 55; Bill, **WN8ONP**, 54; Lou, **KN2GQO**, 41. Bob, **ex-KN2DLC**, 41 (Bob is sweating for his General now). And Henry, **WN3YGK**, 60, an engineer on the Pennsylvania Railroad. Are you one of the youngsters?

Last month, I suggested that, when writing to the *Novice Shack*, you addressed your letters to me in Gary, not in care of *CQ* in New York. Otherwise, there is a delay in my getting them. However, if you do have occasion to write to *CQ* in New York, the correct address is: Cowan Publishing Corp., 67 West 44th St., New York 36, N.Y. Without Cowan Publishing Corp., or *CQ* Magazine in the address, your letter will probably come back to you or end up in the "Dead Letter Office," because the *CQ* offices are in a very large building, containing many other firms and publishing companies.

Until next month, 73, Herb.

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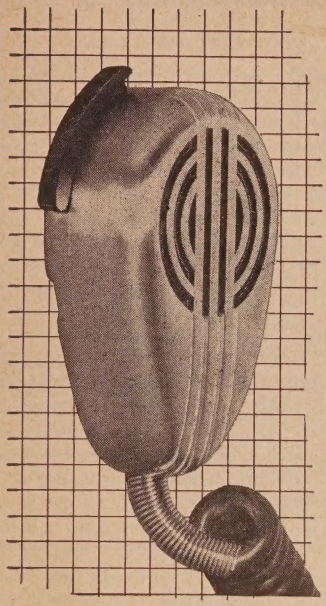

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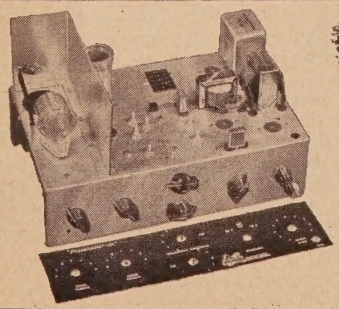

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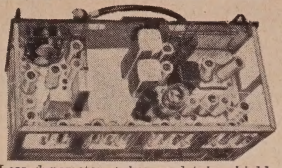

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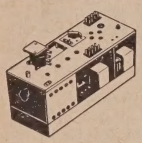

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"JUNKEYBOARD"

(from page 38)

the distant printer. Because of the lack of importance of this key its function is transferred to the right hand key in the second row without any operating difficulty. Since the typewriter has one more key in the second row than a teletype printer we come out even. In *Fig. 1*, notice an additional key on the right hand side of the top row marked "spare" which was left in with the idea of some future use such as remote control. You may remove this one if you wish.

Installing the Contacts

A piece of 3/8" thick Micarta (or other durable insulation) is mounted beneath the keylevers in front of the comb. This strip is fastened to the cast-iron base by two countersunk *6-32* flathead screws on each side. The contact screws will be mounted on this strip. The simplest way to locate the holes for the contact screws is to bolt the Micarta strip in place, press a keylever until it touches the insulation and, with a sharp pencil or scribe, draw a line on each side of the keylever. When the strip is removed a hole can be drilled midway between the lines for each contact screw. The contact screws for adjacent keys should be staggered so that there will be enough room for the nuts underside. *Figure 2* shows the strip with three rows of screws which permitting the use of *10-32* brass screws and nuts. The rear edge of the insulation should be almost in contact with the comb in whose teeth the keylevers slide.

Use non-slotted brass screws for the contacts or else file down the heads of slotted screws until they are flat. Be sure at any rate to clean the screws to remove any tarnish or lacquer. The bottom edges of the keylevers should be scraped and sanded so that a good clean contact will be made with the screwhead.

One-sixteenth inch is a good compromise for keylever motion, but you may use anything from about 1/8th inch to a few thousandths inch. This will result in an almost effortless use of the keyboard.

The square-headed keylever screws (mentioned earlier) should be adjusted so that the "universal" contacts close a few thousandths of an inch before the keylever hits the brass screw contacts. The adjustment is accomplished by holding down a key and screwing in the square-headed screw until the "universal" contacts close and then giving the screw one-half turn more.

In the second part of this article, the author describes the rectifying matrix he developed for use with this keyboard. The matrix is a device enabling the selection of anyone of 80 elements from the keyboard. It is an idea that has been used in computing machines for many years, but to our knowledge has never been applied to Ham radio.—*Editor.*

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LYSCO 600 TVI proof transmitter good condition $75. Eico 425 oscilloscope, new $40. National CRU modulation scope, never used, $18. Heath VTVM, V6 $20. Philip Schwebler, Jr., W2ZHE, Alcove, New York.

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SELL: ELDICO 60-watt transmitter TR-75 TV, and accompanying modulator MD-40P $99. Peter Shaw, W1YPQ, Sutton, Massachusetts.

HARVEY WELLS Bandmaster deluxe screened and filtered, used less than 10 hours, with DPS power supply $100. W2WDT, 1028 Jefferson Ave., Brooklyn 21, New

SELL: Hallicrafters S76 and speaker, S40, Masco amplifier, Turner U9S mike, meters, crystals. W2NBM, John V. Urban, 140-34 Holly Ave., Flushing, New York.

SELL: 32V-1 $375, AR88-D $275, #21A teletype midget tape printer $45, 12,000 ohm d.p.d.t. relays for 110 VDC $1.75, Boehme automatic keyer with McElroy 3-key tape puncher for Morse Code $145; Collins 30-J transmitter, 600 watt input, CW & phone, $325. WANT: ART-13, DY-17, ARN-7, APR-4, APN-9. Cash or trade. Tom Howard, W1AFN, 46 Mt. Vernon Street, Boston 8, Mass. RIchmond 2-0916.

SELL: Crystal calibrators, used in ART-13 transmitters (ATC), require two 12SJ7, 200 kc. crystal. $3.95 postpaid, with schematic. Arrow Appliance, 38 Exchange, Lynn, Massachusetts.

50 WATT, PHONE, CW, TRANSMITTER with power supply $50. W8KSD, 217 Wilson, Ironwood, Michigan.

SELL: HT-9, coils for 80-40-20-10 extra 814, $150. Lysco "600," 30W, VFO, all bands, de-TVI'd, low-pass filter, like new $90. FOB Wausau. W9RQM, 929 South 7th Ave., Wausau, Wisconsin.

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QSLs "Brownie" W3CJI, 3110 Lehigh, Allentown, Pennsylvania. Samples 10c with catalogue 25c.

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QSLs the way you want them. Samples 10c. Vern's Print, 729 Juul, Hutchinson, Minnesota.

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The South Jersey Radio Association Annual Hamfest and Picnic, SEPTEMBER 12, at National Park, N. J. Follow S.J.R.A. signs in from Rt. 130 to Red Bank Ave. and the Delaware River. Help celebrate our 38th birthday by breaking last year's record attendance of nearly 600. Bring food. Free soda, plenty of tables, pavilions in case of showers. Door prizes, fun, games for whole family. Full-size carousel, 50 swings, slides, wading pool. Mobile transmitter hunts on 10,2 meters. Special recognition for oldest licensed Ham present. K2AA will go on air at 11:00 a.m. on 3.895, 29.00 and 145.40 M.C. from the site to talk in the mobiles. Registration $1.00 per family in advance or $1.50 at gate. Send check payable The South Jersey Radio Association, Inc. in care of Bob Barbor, 223 Chestnut St., Haddonfield, New Jersey.

Kansas Hamfest. Johnson County Amateur Radio Club 2nd Annual banquet and Hamfest, OCTOBER 2, at Quivira Lake Country Club near Kansas City, Missouri. Contact James Gossett, WØGLN, 7507 Lowell, Overland Park, Kansas for information.

The Manchester Radio Club is sponsoring the 1954 ARRL New England Division Convention and Hamfest. Location, state armory, Manchester, New Hampshire; date OCTOBER 10. Contests, prizes and speakers. Tickets $5.00 complete—$3.00 minus banquet. Contact Cleo Beauchamp, 386 Reed St., Manchester, N. H. for tickets and hotel reservations.

Greater Washington Area Hamfest sponsored by Washington, D.C. Mobile Radio Club. Sunday, OCTOBER 3, Palisades Park. Pre-registration tickets $2.25 including dinner. For tickets and information contact W3MSU.

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ELIMINATE TVI! Shield your rig. X #26 gage heavy-plated bright steel. Perforated 75 #53 holes per inch. Easily cut, formed and soldered. Sheet 20" x 28". Two for $3.50; five for $6.50, postpaid. West of Mississippi 25c extra per sheet. Sample for 10c in stamps. Dept. 12, Republic Television, Inc., Dumont, New Jersey.

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NOMINAL TRADE-IN will bring you $90. allowance on new Barker & Williamson transmitters or Concertone Tape recorders, $60. on new Viking II, $40. on Viking Ranger, or Elmac AF-67, $30. on Elmac receivers or Pentron Tape recorders, 20% on Lansing, Stephens, Fisher, etc. hi-fi components. TELCOA, Azurelee Dome, Malibu, California. Tel.: GLobe 6-2611.

WILL SWAP OR SELL: New RBU 2 Panapter, never used, $150. Motorola T6920A ten-meter mobile complete, ready to operate on 28,800 kc. $40. GFH mobile or fixed 40-80 transmitter, $30. TU-18 receivers, $4, coils 50c. Viking TVI'd and Collins 310C, $275. Will sell separate. Power transformers for 2500 VDC 1 Amp. $35: 1500 VDC 1 Amp. $25: 850 V 300 mil. $15: 750 V 250 mil. $12: 30-watt Webster PA $30. Weston Model 765 Voltameter Decibel AC-DC 1500 ", 0-30 Decibel $30. Address Radio Box 550, Little Rock, Arkansas.

SALE OR SWAP Hickok 600 tube checker, CREI specialized television engineering course. WANT: National receiver, tape recorder, or what have you. W3LRW, Box 63A, RD 2, Wexford, Pennsylvania.

(More on pages 70 and 71)

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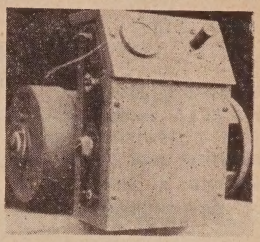

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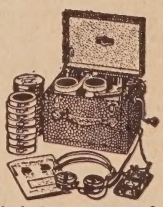

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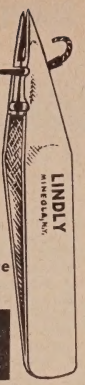

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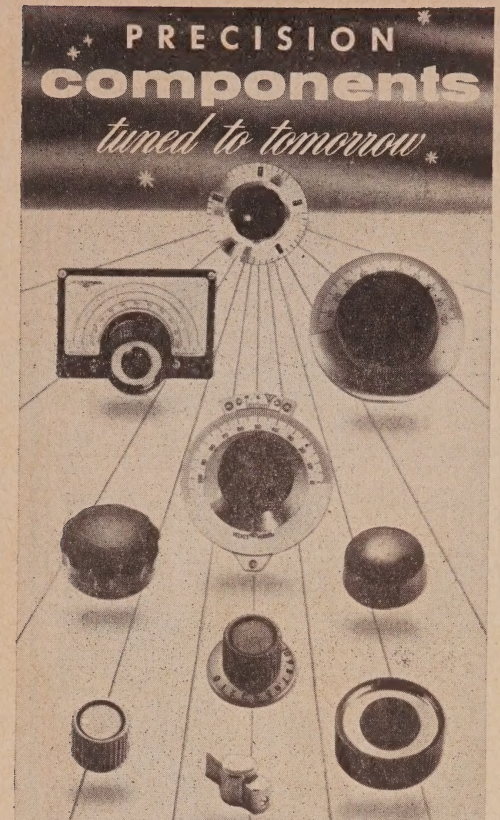

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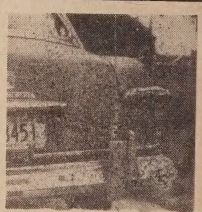

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